# ARCHÆOLOGICAL SURVEY

OF

# BENGAL.

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# REPORT

## 1888.

BY

JOSEPH DAVIDITCH MILIK-BEGLAROFF,

CIVIL ENGINEER,

ARCHÆOLOGICAL SURVEYOR, BENGAL,

*Late Executive Engineer, Ancient Monuments, Bengal.*

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## PART II.

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## ARCHITECTURE AND ART.

CHOGDA, BENGAL,
INDIA,

*The* 11th Nov 1888.

*To*

J. Ware Edgar Esq.

Dear Mr Edgar.

THE following pages contain my report for 1888 ma
Archœology of Bengal, and I beg respectfully to submit it t me
your kind perusal and for any suggestions or criticism iana
may be so kind as to favor me with. \ not

I am so convinced of the importance of obtaining the opinions, suggestions, and criticisms of the learned world, and of my professional brethren and leaders in the ranks of Engineers and Arcl tects, with the view of eliminating errors that may have crept and of meeting their wishes and requirements, (which after all the real criterion of the present usefulness of all practical researc that I have accepted the cost of printing and privately circulating the report; but it would be utterly beyond my pecuniary means to accompany it with the hundred and eleven plates which ought to accompany it. For the few plates that accompany, I am indebted to the kindness of the Superintendent of the Calcutta Government School of Art, Mr. W. H. Jobbins, who has succeeded in lithographing and printing them at the exceedingly cheap cost of Rs. 16 per plate (average).

With my assurances of respect, I beg to remain,

Yours &

Jos. D. MELIK-BEGLAR.

# NOTE.

In last season's report, there are certain press errors which are obvious; but there are a few which are important and need to be corrected, due to the press and to my inadvertence; of these, the most important are given below with their corrections:—

At page 42 table, for 450 read 430, in column 2 opposite Krishna Gupta. At page 42 last column, opposite Sri Varmma read 598 in place of 570; Griha Varmma was killed on the same day by the King of Malwa that Prakasa or Prabhakara Vardhana died, *(i. e.,)* A. D. 598, and consequently, Sri Varmma could not have ascended the throne in 570 A. D.

Nor, as Sri Varmma began to reign from A. D. 598; can Madhava Gupta's accession be placed at 575, for Mahasena Gupta was by the Afsar inscription a contemporary of Sri Varmma; consequently Mahasena Gupta must have gone on reigning till certainly 598 A. D. probably 600 A. D. in round numbers; and consequently, Madava Gupta Bhava Deva's accession, I would place, now, correcting myself, at 600 A. D. in place of 575; and I beg the correction from 575 to 600 be made in column 2 page 42 opposite Madhava Gupta, Bhava Deva: and as a consequence that a further correction be made, in the accession of his successor Narendra Gupta Sasangka Deva, in column 2 page 42, from 595 to 605 A. D.

But as Narendra Gupta Sasangka Deva murdered Kshettra Varmma in 607, and as Sri Varmma his predecessor only ascended the throne in 598, we cannot possibly place Kshettra Varmma's accession in 590; the most probably simple date would be 605; and I beg that in the last column, page 42, opposite Kshettra Varmma, the date 590 be altered to 605; thus giving Sri Varmma a reign of 7 years, and making Kshettra Varmma and Sasangka Deva contemporaries as they ought to be.

In page 45 I have after fixing certain dates said "the sake of simplicity therefore, I place, &c." Completely losin sight of the fact, that only a few paragraphs before, I had said that Prabhakara had died in 598, and of course Graha Varmma had been killed on the same day; the case is not one of "simplicity" at all, but of very narrow issues, and there is no escape from the alterations I have now made in my own copy, and request to be made in those which are now in other hands.

I do not see on what grounds Cunningham in page 156 vol. IX says, that Prabhakara Varddhana, the father of Rajya Varddhana, was killed by Gupta, King of Magadha; or that his death was instigated by Sasangka: As only 2 pages previously he extracts from the Harsha Charitra to shew that Prabhakara Varddhana died in his bed, I suspect the Prabhakara Varddhana of his page 156, is a misprint for Rajya Varddhana.

I beg further that the corresponding corrections he made in the body of the text where necessary.

Since the printing of this report, I have found reason to give up wholly my opinion, that the circular basement which I have conjectured a stupa in page 5, (S. in index plate) and which in page 13, I have said, was supposed the base of a minar by the Director-General, and (page 14) a well by Babu Raj Mohan Banerjya the draftsman; was a stupa. It turns out to be a well: on removing the upper solid layer, a brick ring about 18 inches thick was laid bare, and as it is too thin to be the base of a minar, and just the usual thickness of well-rings, I unhesitatingly, and at once, give up my own supposition that it was a stupa, in favor of Babu Raj Mohan's conjecture that it was a well: and along with this abandonment of my supposition of its being a stupa, the whole of my difficulty, in ascribing, what, *on that supposition, I was compelled to consider a Buddhist Temple,* to the Orthodox Hindu, Aditya Sena Deva or Adisur, vanishes; I now hold, that the Adina Masjid, marks the site of a Saivic (as evidenced by the Argha and the Lingam) Temple, built by Aditya Sena Deva.

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# ARCHÆOLOGICAL SURVEY OF BENGAL.

## PART II.

## 1888.

## ARCHITECTURE AND ART.

### PRELIMINARY.

In submitting this section of Part II (that is the technical part) of my report to the Government, I beg respectfully to submit a few observations which appear to me called for in regard to the drawings which accompany, in explanation of the work of the season, and generally on such incidental points as cannot be embodied in the technical portion, but naturally would be expected in a preliminary introduction to the report.

The building which is the subject of this report, the Adina Masjid, is one of a series of buildings, all built within 50 miles of each other, at Rajmahal, at Gaur in Malda, and in Pandua; the dates of almost every one of them, (the important exception being the Masjid at Rajmahal) are well known, and the material is almost identical. The largest and most important of them all, and indeed the largest Masjid in Bengal, I might almost have said in India, but for the circumstance that I happened to be the officer who, in investigating the remains at Delhi discovered (see Vol. IV. arch rep. Cunningham) the real dimensions of the great Alai Masjid the Kutab Masjid as enlarged, or rather in course of being enlarged, by the great Alauddin; is the Adina Masjid; of which alone the drawings are ready; of the others the drawings are only in progress and will not be in a state to begin writing about, till the close of this current recess season 1888-89.

Had I my way in the writing of the report, I would have deferred writing the technical report on this great Masjid, till the drawings for the others, were far enough advanced to have enabled me to take up all these Masjids, which form a group by themselves, distinctly, though in a yet undefinable way different, from Muhammadan ecclesiastical architecture elsewhere; it would then, and only then have been possible to deal with the subject, in a comprehensive spirit, instituting comparisons, learning myself, and pointing out to others who have less leisure

and opportunity to devote to the subject which I am paid to study, the sequence of alterations in the various prominent and minor features: in short; attempting to evolve the principles, which underlying them all, notwithstanding apparent differences, might lead to the discovery, or at learnt render more hopeful the discovery of the laws if any, which the architects observed; and not merely the laws, but the progress, positive or negative, and the tendency of this progress, the growth or the decline, of a great science, as exemplified in actual existing most important examples.

I have in a previous report pointed out, that no complete treatises or even nearly complete treatises on Hindu Architecture exist, or at least are accessible to the general public or to the professional inquirer. The Director General informs me that in the Bombay Survey, a man possesses a complete treatise on the subject, and that the rigid system of subdivision used by Hindu masons, is well known to most people who have interested themselves in the subject; but as all my own research tends to establish quite a different sort of law, a law highly elastic and not rigid, and as I, and I fear many others on the Bengal side of India, do not happen to know of the rigid system of subdivision alluded to, whatever it may be, I can only wish that some one had the courage and the public spirit to render it accessible to the general public interested in such matters, by translation and publication.

However this may be, it becomes necessary now to point out what is even stranger, if only to elicit such similar note in regard Muhammadan architecture, as my former note has elicited in regard to Hindu architecture, that absolutely not even a fragment of a work on Indian Muhammadan architecture, has ever (to my knowledge, possibly Bombay possesses them) been found, much less published.

It is simply inconceivable that great buildings, all so far as can now be seen (in the absence of careful scientific comparison) of the same general ensemble, yet different from each other, as men whether in Scotland or in Timbuctoo, resemble, yet differ from each other, could have been built without some salient and universally (as regards them) recognised architectural laws.

Such laws it is manifestly impossible to educe from one or even two examples; what is absolutely needed, is a fairly unbroken sequence, and this sequence by a fortunate accident happens to be available for investigation, in the buildings in Rajmahal, Gaur and Pandua.

The Director General's opinions and orders however, were distinct; and in obedience to them, against my perhaps sanguine or prejudiced, but nevertheless sincere conviction, I

submit a fragmentary report—fragmentary however only in the sense I have above indicated, but as will be seen, as regards itself alone, as complete as under the circumstances it was possible for me to make it.

I would have preferred writing part I (History and Tradition) of the report, as regards Bengal proper, for which, I had last season, in anticipation, begun to prepare the material. From what Government have already seen of part I of my last report on Anga, I believe it will be admitted, that a report on Banga (the adjacent great political state to ancient Anga) would have appropriately followed it, as gradually disposing, so far as their history and tradition were concerned, of the various great ancient kingdoms, which being conterminous, could not but have many note-worthy points in common, and could not but have acted and reacted, and had intimate dealings with each other; had time permitted, Magadha on the other side of Anga, would have appropriately been next taken up, and indeed in some such hope, I had been collecting material last season for Magadha also. My time would have thus been fully and usefully occupied, and although as regards personal labor, it would have been necessary for me to have labored harder in carrying out my own programme, I would also as compensation, naturally have enjoyed greater pleasure, for it is a truism, that in doing what one feels an interest in, the greater the labor, the higher the pleasure.

In carrying out the orders of the Director General, I have obtained some little relief from intense mental labor, and for this my thanks are assuredly due to him; it does not appear to me however that the Government which pays me has quite obtained the maximum of what they might have otherwise obtained, for the money which I have drawn as salary, although they have got a fair adequate return.

The drawings which accompany, and are detailed in the accompanying list, have all been measured and drawn by the able draftsman of the survey Babu Raj Mohan Banerjya. As he has been recently dismissed from this survey, and this is probably the last work he will have done in the archœological survey, it is only ordinary justice to him, that I should unhesitatingly and fully acknowledge, my great obligations to him. Without him, these drawings would in all probability, not have been ready by this time, if indeed the proposed staff of cheap (30 Rupees a month) draftsmen, could have executed them at all, while his powers of observation have been such, that I have received very material assistance from him in drawing up my report. He has read this report at my request, and endorses my views except where I have specifically mentioned that we differ.

A few words are necessary in reference to the drawings: They are all drawn to a scale of $\frac{1}{20}$ except the index plate which is on a scale of $\frac{1}{200}$, plate 24 or a scale of $\frac{1}{300}$, and plates 25 to 87 which are drawn full size and which shew the ornamental work.

On such a scale as $\frac{1}{20}$ it was inevitable that the drawings or at least some of them, should be very large, but on this point, with the distinct order of the Director General to make the drawings larger than they are finally intended to be in publication, preferably four times as large, no further explanation from me is necessary; should it however appear desirable that the aid of the Government School of Art be obtained, in publishing the drawings in future, in ordinary lithography, which, from some specimens that the School has executed, appears quite suited to the work of the Bengal Circle, instead of in photographically reduced collotype, not only will it in future, not be necessary to make the drawings larger than finally intended, but the cost of publication will be so considerably reduced, as to bring a volume with a hundred plates, well within the means of the poorer students of Indian Architecture. This is a point on which I can however only offer respectful suggestions for the consideration of Government.

In making the drawings it has been my aim to restore, as far as such restoration was possible with absolute certainty, those parts which are defective. For instance the various cornices shewn as perfect, are not so, but one moulding occurs in some one partly broken portion, and another moulding occurs in some other broken part of the same cornice, I have put together all these fragments, of whose actual existence, and relative positions, there can he no possible doubt, and thus restored the original cornice which has been shewn as intact in the drawings; but there is nothing in the drawings to shew that these parts really thus pieced together are not now in good order in the buildings.

It may he objected that the drawings consequently do not shew the building as it is, but rather as it was when fresh from the architects hand; I admit that this is so, and consider that I am right in doing what I have done, for I really do not see, on what principle the drawings could shew some dilapidations and not others, while it is at the same time obvious, that if every dilapidation, is to be shewn, such as every missing brick or stone or ornament or patch of plaster the drawing will become simply unintelligible, to say nothing of the time lost and labor incurred, in first measuring and noting, and next in drawing them.

For those therefore who wish to see the actual condition of the building, these drawings are not meant, but I have on careful consideration thought it desirable to supplement these technical drawings with photographs, from which those who so desire, may see the actual state of the building, in much detail; they may also consult Ravenshaw's work for this purpose.

These photographs are also useful for demonstrating, if ever the necessity should arise, the accuracy of my restorations.

But there are portions of which no traces exist at all, and for restoring which with absolute certainty, I possess no materials; these I have restored (so as not to destroy the appearance of the drawing) to the best of my judgment, from examples elsewhere. Such conjectural restorations are shewn in dotted lines as distinguished from the full lines, in which the restorations, regarding which I possess absolute proofs, are shewn. On these restorations, while urging and mainting my views, I am open to correction, and shall thankfully accept such correction as may be shewn to be necessary.

It will be seen from the text that there are frequent, and indeed unavoidable references to photographs, and the report would not be so lucid without these references as with. But the remuneration offered by the Director General for photographs, did not sueceed in attracting a single plate, as indeed it could not, the remuneration being (I have good authority for saying so) insufficient.

I happened however to possess the needful photographs, done when I was not a servant of Government in the Archœological Department, and as the necessity of these photographs, rendered itself evident to me, in the course of writing the report, I have ventured to avail myself of them in illustrating this report.

It will be seen, that the plan of the Masjid given in Ravenshaw and in Cunningham, do not agree with each other, nor with mine. I have carefully verified the correctness of mine however, by independent measurements done, by the draftsman, and by myself personally, and I am satisfied, both Cunningham and Ravenshaw were in error: nor is this to be wondered at when it is remembered that the place was a dense jangal through which narrow paths had to be cut to enable Ravenshaw to take the needful photographs; "a gang of two hundred men" being employed for the purpose.

The photographs as given by Ravenshaw and those now submitted also differ; those now submitted being complete photographs of parts which in Ravenshaw's time were buried in rubbish, but over and above this, there are differences, as portions then intact, have since fallen.

That much of the ornamental and sculptured stone, of this Masjid has been carried away in recent times, is certain; several are now in the Calcutta Museum, while others I know, had been packed for despatch to England, by the then Magistrate of the district Mr. Porch.

Thus much with reference to the field work, treated in detail in this report: but there has been more work done this season.

The drawings now in progress, and which will be advanced enough to write about, at the close of the current recess season, are detailed in the following listy; all of them will it is expected be finished so far as the pencil work is concerned, and it is hoped will be inked in during the ensuing field season while I will be in camp, by the draftsmen at Head-Quarters, ready against the next recess.

As regards Mr. Garrick's work, the whole of the drawings in the list III below, which pertain to Rohtasgarh have been or are to be executed by him, it is hoped they will be delivered ready by the 15th October, as also his report for the past field season. The drawings include those measured, and executed, which are expected to be finished; during the past as well as the current season.

There will then still remain for measurement and drawing, the drawings as per list IV which accompanies; it will be seen that 20 drawings have yet to be measured for and drawn, before a complete report on Rohtasgarh can be written.

Government have sanctioned Mr. Garrick's leave with the proviso, that his work should be sent in on the 15th October, and as this report and its accompanying drawings (in fact the season's report) has to be submitted by the 15th September, and Mr. Garrick is on leave, and his work cannot be expected till the 15th October, his drawings and report do not accompany.

Besides these, the lists below give further, a detail of the drawings which have reference to the report submitted by me last season, but which were returned by the Director General and are now in this office: and a detail of the drawings for which material exists in this office.

The drawings sent with Mr. Garrick's report of last season, but which for reasons elsewhere given, I had not an opportunity of seeing, have been returned direct to him by the Director General; they are not in my office, have not passed through my office, nor do I possess any details regarding them.

As regards discoveries of inscriptions during the past field season they have been already detailed in full in the prescribed form, and incorporated in the "list of Bengal Inscriptions," and

need not be further detailed here. The original impressions themselves have also been already submitted to the Director General.

In conclusion I beg to represent, that when the report on the Gaur and Rajmahal buildings comes to be written, it will be necessary that the drawings of the Adina Masjid now submitted be returned to me to enable the subject being treated in a comprehensive manner and the needful comparison with the Adina Masjid instituted.

## LIST I.—Drawings which accompany this Report.

| No. | Details of Drawings. | Scale | Size. |
|---|---|---|---|
| | Index Plate ... ... ... ... ... | 1/1000 | Single 4 to. |
| 1 | Elevation of South West corner ... ... ... | | Octuple 4to. |
| 2 | Part plan and elevation of East Face .. ... | | Qdrple. 4 to. |
| 3 | Section of East cloisters ... .. ... | | Qdrple. 4 to. |
| 4 | Plan of abutment of face of main vault (on line A. B. see plate 5) and Section on line C. D., .. .. | | Sextple. 4to. |
| 5 | Details of main vault, half elevation main vault and abutment ... ... ... ... | | Twelve 4 to. |
| 6 | Details of main vault Section on line G. H., (see plate 5) | | Twelve 4 to. |
| 7 | Plan at A. B., (see plate 8) ... ... ... | | Double 4 to. |
| 8 | Elevation of back of West wall from centre of Masjid to centre of back entrance ... ... ... | | Sexple. 4to. |
| 9 | Section on line C. D., (see plate 7) ... .. | | Double 4to. |
| 10 | Do. on line E. F., (see plate 7) ... ... | | Triple 4 to. |
| 11 | Section on line A² B², (see plate 1) shewing elevation of prayer-niches and cross section of pulpit up to inner cornice of main vault ... ... ... | | |
| 12 | Section, (see plate 1) upper part (for lower part see plate 11) ... ... ... ... ... | 1/20 | Double 4to. |
| 13 | Section on line Q. R., (see plate 24) ... ... | | Double 4to. |
| 14 | The pulpit, plans and section on line E. F. ... ... | | Double 4to. |
| 15 | Section on line A. B., (see plate 24) inside elevation of West entrance door ... ... ... | | Double 4 to. |
| 16 | Details of a prayer-niche ... ... ... | | Single 4 to. |
| 17 | Section on D. E. with details of niches, (see plate 24) ... | | Triple 4 to. |
| 18 | Details of upper niche on line F. G., (see plate 24) ... | | Single 4 to. |
| 19 | Section on H. K., shewing doorway to the King's platform, (see plate 24) ... ... ... | | Single 4 to. |
| 20 | Section on L. M., shewing archway, (see plate 24) | | Single 4 to. |
| 21 | Elevation of West wall shewing doorway N., (see plate 24) | | Double 4 to. |
| 22 | Section on line O. N. P., (see plate 24) ... ... | | Octuple 4to. |
| 23 | Details of the Fourth prayer-niche from North end on the West wall .. ... ... ... | | Double 4to. |
| 24 | Plan. North-West end and Section on line S. S. ... | 1/300 | Single 4 to. |
| | **Details of Ornaments.** | | |
| 25 | Index plate for side and main prayer-niches .. .. | 1/20 | Single 4 to. |
| 26 to 54 | Details of Ornaments ... ... ... | full size. | 17 Single & 12 Double |
| 55 | Index plate for pulpit ... ... ... ... | 1/20 | Single 4 to. |
| 56 to 64 | Details of Ornaments ... ... ... ... | full size. | Single |
| 65 | Index plate for niches in King's platform ... ... | 1/20 | Single 4 to. |
| 66 to 87 | Details of Ornaments ... ... ... ... | full size. | 16 sgle 5 dle. 1 of 16 4to. |
| 88 | Impression of an inscription found in the ruins ... | f. s. | Single 4 to. |
| 89 | View of S W. Corner tower ... ... | Photographs. | Size of Photographs 10" × 8" |
| 90 | Do. King Chamber ... ... ... | | |
| 91 | Do. a doorway of King's Chamber ... ... | | |
| 92 | Do. a niche in King's platform ... ... | | |
| 93 | Do. a niche in N. W. Cloisters ... ... | | |
| 94 | Do. pulpit and main prayer niche ... ... | | |
| 95 | Do. main prayer niche ... ... ... | | |
| 96 | Do. side prayer niche ... ... .. | | |
| 97 | Do. niche at back of pulpit ... ... ... | | |
| 98 | Do. shewing ribs of vault ... ... ... | | |
| 99 to 108 | Do. of plaster work in spandrils and of ornamental arch filling ... ... ... Do. of ornamental arch filling of different patterns | | |
| 109 | General view West wall ... ... .. | | |
| 110 | Do. East wall ... ... ... ... | | |

Total 88 plates and 22 photographs.

**LIST V.**—Drawings in progress, with detail of their state of progress, but which do not accompany this report, the measurements for them were made during the last season except for Konch which was measured 1886-87,

| | GAUR. | STATE OF PROGRESS | SCALE. | SIZE. |
|---|---|---|---|---|
| 1 | Kadam Rasul Masjid, half ground plan half plan at roof .. .. .. .. | Drawn in pencil | 1/50 | Double 4to. |
| 2 | Kadam Rasul, half elevation and half section .. | Drawn in pencil except ornamental mouldings | 1/50 | Do. |
| 3 | Kadam Rasul, details .. .. | Drawn in pencil. | 1/20 & 1/5 | Do. |
| 4 | Plan and elevation of Tomb in the Court of the Kadam Rasul .. .. .. .. | Finished except printing | 1/50 | Do. |
| 1 | Small Sona Masjid plan .. .. .. | Drawn in pencil | 1/50 | Triple 4to. |
| 2 | Small Sona Masjid half elevation half section .. | Drawn in pencil except ornamental mouldings | 1/60 | Do. |
| 3 | Cross section and details of small Sona Masjid .. | Drawn in pencil except ornamental mouldings | 1/60 | Do. |
| 4 | Details of small Sona Masjid.. .. .. | Drawn in pencil. | 1/60 | Double 4to. |
| | RAJMAHAL. | | | |
| 1 | Ground plan of the Jama Masjid .. .. | Finished in ink except printing | 1/60 | Qdple. 4to. |
| 2 | Half elevation half section of the Jama Masjid .. | Do. | 1/60 | Sextuple 4to. |
| 3 | Section of the Jama Masjid on line G. H. .. .. | Do. | 1/60 | Double 4to. |
| 4 | Plan of the roof of the Jama Masjid .. .. | Do. | 1/60 | Qdple. 4to. |
| 5 | Block plan of the Jama Masjid and Court .. | Do. | 1/200 | Double 4to. |
| 6 | Back elevation of the Jama Masjid and section through Court .. .. .. .. | Do. | 1/200 | Do. |
| 7 | South gateway of the Jama Masjid plans elevations and section .. .. .. .. | Drawn in pencil | 1/40 | Qdple. 4to. |
| 8 | East gateway of the Jama Masjid, plan, elevations and section, .. .. .. .. | Do. | 1/40 | Do. |
| 9 | Plan of upper story at end.. .. .. | Do. | 1/60 | Double 4to. |
| 10 | Section of the Jama Masjid on line A. B. C. D. E. F. | Do. | 1/60 | Do. |
| 1 | Plan of the Baradwari .. .. .. | Do. | 1/60 | Do. |
| 1 | Temple behind Masjid, plan, elevation and section | Do. | 1/20 | Do. |
| 1 | Bridge over the Tinuah Nala plans .. .. | Do. | 1/60 | Qdple. 4to. |
| 2 | Bridge over the Tinuah Nala elevation and section | Do. | 1/60 | Do. |
| | CHHAPRA. | | | |
| 1 | Tomb at Chhapra plan .. .. .. | Finished. | 1/60 | Double 4to. |
| 2 | Tomb at Chhapra elevation and section .. | Finished. | 1/60 | Do. |
| | CHAYANPUR. | | | |
| 1 | Tomb at Chayanpur index plan .. .. | Partly done in pencil. | 1/300 | Do. |
| 2 | Plan of tomb proper at Chayanpur .. .. | | 1/60 | Triple 4 to. |
| 3 | Plan of tomb proper in Chayanpur at the pavilions | Do. | 1/60 | Do. |
| 4 | Tomb at Chayanpur half elevation, half section of tomb proper .. .. .. | Do. | 1/60 | Qdple. 4to. |
| 5 | Tomb at Chayanpur main gate plans .. .. | Do | 1/60 | Single 4to. |
| 6 | Tomb at Chayanpur, main gate, elevation .. | Do. | 1/60 | Do. |
| 7 | Tomb at Chayanpur main gate, section.. .. | Do. | 1/60 | Do. |
| 8 | Tomb at Chayanpur, corner pavilions, elevation and section .. .. .. .. | Do. | 1/60 | Do. |
| | KONCH. | | | |
| 1 | Temple plan .. .. .. .. | Finished. | 1/60 | 4 to |
| 2 | Temple half elevation half section side .. .. | Do. | 1/60 | Double 4to. |
| 3 | Temple half elevation half section back .. | Do. | 1/60 | Do. |
| 4 | Details of ornament Temple.. .. .. | Do. | Full size. | Qdple. 4to. |
| 5 | Details of moulding Temple.. .. .. | Do. | 1/20 | Single 4to. |

Total 37 plates equal to 91 Quarto plates.

**LIST IV.**—Drawings proposed to be measured and drawn during the ensuing field Season, by Mr. H. B. W. Garrick being the yet unfinished balance of the programmes of 1885-86, 1886-87 and 1887-88.

1 Sheet of details of Rohtasan Temple.

1 Plan of large or Rohtasan Temple.

1 Plan of the Ganeç Temple.

1 Section of the Raj Ghat Gate looking towards the Son River.

1 Section of South half and elevation of North half of the Kathautiya Gate looking to West.

1 Plan of Masjid attached to the Habshis Tomb.

1 Block plan shewing Cloisters and Privies as well as main building. Shish Mahal ; ground floor in full, upper floor dotted in.

2 Sheets of details of Shish Mahal and Cloisters.

1 Plan of Hammam and Privies attached.

1 Section of Phul Mahal complete.

1 Diwan-i-Am, complete section shewing Vaults in ground floor, as well as Towers above, looking South.

1 Plan of 2nd floor, and of Towers and Stairs, Diwan-i-Am.

2 Sheets of details.

1 Plan ground floor of the Hathiya Pol.

1 „ upper floor and of Towers Hathiya Pol.

1 Elevation of North half and section of South half looking East, of the Hathiya Pol.

1 Cross section of the Hathiya Pol looking South.

1 Sheet of details of the Hathiya Pol.

Total 20 drawings yet needed to complete the illustration of the buildings in Rohtasjarh before they can be written about in a comprehensive spirit, or a complete report on Rohtasgarh can be drawn up.

Besides these, there are needed some more drawings of the Tomb of Sher Shah at Sasseram not yet drawn so as to fully illustrate for technical purposes this most Noble of all Mausoleums in Bengal.

**LIST III.**—Drawings expected to be received by the 15th October with Mr. Garrick's report, and relating to Rohtasgarh, measured and drawn, or being drawn by Mr. H. B. W. Garrick, Assistant Archæological Surveyor, Bengal, during field Seasons; 1886-87; 1887-88.

| No. | TITLE AND DETAIL. | SCALE. |
|---|---|---|
| 1 | Small Temple at foot of Rohtasan plan ... ... | 1/30 |
| 1 | Rohtasan Temple, elevation of West face ... ... | 1/30 |
| 1 | ,, Do. Section E. W. ... ... ... | 1/60 |
| 1 | Ganeç Temple, section ... ... ... | 1/20 |
| 1 | Lal Darwaza, plan ... .. ... ... ... | |
| 1 | Singh Darwaza, plan ... ... ... ... ... | |
| 1 | Kathautiya Darwaza, plan ... ... ... ... | |
| 1 | Raj Ghat Gate, plan ... ... ... ... ... | |
| 1 | Habshis Tomb, plan ... ... ... ... | 1/60 |
| 3 | Baradwari, plans ... ... ... ... ... | |
| 1 | Baradwari, elevation East face ... ... ... | 1/30 |
| 1 | Baradwari, elevation North face ... ... ... | 1/30 |
| 1 | Section of Baradwari ... .. ... ... | 1/20 |
| 1 | Details of Baradwari ... ... ... ... | 1/10 |
| 2 | Shish Mahal, plans ... ... ... ... | 1/60 |
| 1 | Shish Mahal, section ... ... ... ... | 1/30 |
| 1 | Phul Mahal, plan ... ... ... ... | 1/30 |
| 1 | Diwan-i-Am, elevation of first floor ... ... ... ... | |
| 1 | Diwan-i Am, plan first floor ... ... ... ... | |

Total 22 drawings of the Rohtas buildings measured and drawn during the Seasons 1886-87 and 1887-88.

**LIST II.**—Finished drawings returned by the Director General Archæological Survey, to the Archæological Surveyor, Bengal, and now in his office.

| | | Scale. | Size. |
|---|---|---|---|
| 1 | Temple at Umga, elevation and plan ... | $\frac{1}{60}$ | Quadruple 4to. |
| 2 | Temple at Umga, section across ... | $\frac{1}{60}$ | Double 4to. |
| 3 | Temple at Umja, section longitudinal ... | $\frac{1}{60}$ | Double 4to. |
| 4 | Temple at Umga, diagrams illustrating composition ... ... ... | $\frac{1}{300}$ | 4to. |
| 5 | Temple at Umga, details ... ... | $\frac{1}{12}$ | Double 4to. |
| 1 | Temple at Chakdah, plan elevation section and details ... ... ... | $\frac{1}{30}$ | Octuple 4to. |

**LIST VI.**—Drawings for which complete materials exist but which have not yet been drawn, on Whatman's drawing paper as ordered by the Director General; with remarks as to when the materials were obtained.

| | |
|---|---|
| Tomb at Shamshernagar, measured season 1887-87 ... ... ... ... | This will make probably 2 plates. |
| Fortified Serai and gateways and masjid at Daudnagar, measured season 1887-88 ... | This will make probably 5 plates. |
| Tomb, Tank, Ghat, and Masjid at Maner measured season 1887-88 ... ... | This will make probably 25 plates. |
| Tomb of Hasan Khan at Sasseram measured season 1885-86 ... ... ... | This will make probably 20 plates. |
| Temples at Kylas in Bhagalpur District measured season 1885-86 ... ... | 2 plates. |
| Temples in the nameless new fort near Umga measured season 1885-86 ... ... | 4 plates. |
| Miscellaneous, measured season 1885-86 ... | 2 plates. |

Total material on hand to be worked up probably into 60 plates besides photographs.

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# ARCHÆOLOGICAL SURVEY OF BENGAL.

## PART II.

## 1888.

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## ARCHITECTURE AND ART.

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# REPORT.

The Masjid of Adina, the subject of this report, is situated about a mile and a half to the North of the small village of Pandua, in the Malda district; it stands by the side, and to the right of the present (which happens to be also the ancient) road from Gaur and Malda to Dinajpur.

The building consists of a great nave, once roofed over by a pointed tunnel vault, but now, roofless, and open in front towards the East; flanked on each side by 18 aisles, also mostly roofless, facing an oblong open courtyard, the other three sides of which, are also fronted by aisles, less in depth, but of the same general character. The external dimensions of the building being 516′-0″ × 313′-0″ and that of the inclosed court 419′-0″ × 186′-0″. From the external West face, a little to the North of its middle, projects the remains of a square (now roofless) chamber, 54′-0″ × 48′-0″ in external dimensions; and in continuation of this, northwards, projects a second chamber, (also roofless) 41′-0″ × 41′-0″ in which an outer entrance and ramp, gave access to the raised floor of the first projecting chamber.

This building with its projections, stands within an outer inclosure, of irregular shape, which appears to have been bounded on three sides, the N. W. and S. by walls; and on the East by a wall and a pair of tanks: One entrance in the West wall opening from the road, and an open space or road, between the pair of tanks on the East, forming the entrances to this inclosure.

It is probable, judging from a low, narrow, long mound, to the East of the pair of tanks, that the North and South inclosure walls, were continued eastwards beyond the points marked on the plate, (Index plate) on to the line of low narrow mound just mentioned, which runs North and South at about 50 ft. distance from the

tank; when they turned, forming the East boundary wall; with some sort of gateway in the middle. Here indeed the height and conspicuousness of the mound, indicates, that some building once stood; but as no examination by excavations was made in these mounds, it would be purely a conjectural plan, to so extend the lines of walls: the portion marked on the plate, defines that part, of which remains were actually found in situ, and ascertained, beyond possibility of doubt, to have formed a continuous narrow line of walling.

Outside the inclosure walls, runs on the West, the present road from Malda to Dinajpur; the road as at present, is not exactly parallel to the wall; but this is doubtless due to the inevitable slight variations, which all kacha roads continuously undergo, by the traffic abandoning the cut up portions of the road, for the comparatively firmer ground on the sides. This road however, is the ancient road, which is said to have been made, or commenced, by Ghiasuddin Iwaz about A. D. 1211.

In Part I will be found reasons for identifying Gaur, with the capital of Hiouen Thsang's Kietchou-ou-Khilo (Kie-chu-Hou-Khi-lo of Beal) but even if this identification be not admitted, there is no doubt of Gaur having been for many years, previous to the Muhammadan invasion, certainly during the rule of the Senas, the capital of some of the earlier Senas, as well as of the last unfortunate Hindu King. From this capital Gaur, roads would naturally radiate to Hiouen Thsang Punnafatanna, (which I agree with Cunningham in identifying with Mastangarh) and to other places of note around; one certainly to Devikot, (near Dinajpur) which assuredly was an ancient capital, and continued to be a place of note, down to the Muhammadan period, as it is mentioned by their historians (Cunningham reports XV.) This road, would necessarily run past the site of the Adina Masjid, to avoid the marshes, which a road, crossing the then course of the Ganges lower down, would have to encounter; the road therefore, dates to a period, long anterior to the Muhammadan invasion, and the Muhammadan historians' record of the making of the road, would refer to the embanking and paving of the already existing track.

That this is so, is rendered certain by the circumstance, that the entire road, wherever not overlaid by recent embankment, or cut through, is actually paved, with a layer of brick on edge, along the entire distance, so far as I have seen it, for a width of 15 to 18 feet:—the bricks being, not the large Hindu bricks of 18″ × 12″, or even the mediœval 10″ × 8″, but the small Muhammadan brick of which the Masjid is built.

But though the road is paved, and the Masjid built, of the small Muhammadan brick, (except in the arches where the

bricks are large) the West boundary wall of the Masjid, is built, not of the small Muhammadan brick, but of the large Hindu brick; and it runs, not parallel to the Masjid, which a boundary wall *built for the Masjid* would do, but parallel, and indeed along the right side of the *road;* its direction being, so far as can be seen, dependant, not on the Masjid, but on the pre-existing road.

These facts would render extremely probable, that the West boundary wall existed prior to the Masjid, and indeed prior to the Muhammadan period; but fortunately it is not necessary, in the case of this wall, to confine ones self to probabilities; there is the most conclusive evidence of the absolute certainty of the wall being pre-Muhammadan.

It will be seen (Index plate) that in the West boundary wall, is an entrance, and careful examination of the drawing, (it is on a small scale) will shew, that at this opening, the straight thin wall, is thickened by successive projections from its surfaces, both inwards and outwards; the result is, that the entrance itself is a narrow passage between the thus formed two rather deep jambs.

But what is curious is, that the two jambs forming the side walls of the passage, are not parallel; the width of the opening at the outer, or road end of the passage, being just barely 6 feet while that of the inner or Masjid end is 6′-9″.

What is still more curious is, that while the right jamb (on entering) has a smooth even surface, as also have the projecting facets, the left one has, for the most part, a rough surface, as if the bricks had been cut, after they had been built; although the facets, both in and out, have smooth surfaces.

And lastly it will be seen, that while the Southern jamb is perpendicular to the direction of the wall, the Northern jamb makes an angle which is very far from a right angle, with the direction of the wall; and that, the prolongation of its surface, falls on the little postern in the West wall of the Masjid.

It is impossible that the North jamb alone should have been built originally, askew to the direction of the wall, and unconformable to the South jamb; for if, by reason of the position of the postern, it had been so built, its surface would not have presented the irregular appearance of having been roughly cut, but would have presented the even surface of a wall, originally set out askew; and the South jamb, would have, naturally, also pointed to the postern, and been parallel to the North one; or at the worst, would have been askew to the direction of the inclosure wall to the same degree, but in a symmetrically opposite direction; which it is not.

The only possible explanation of the irregularity is, that the North jamb was originally built parallel to the South one, as any Architect in his senses would have done, but was subsequently cut to the angle it now has.

And further, that the entrance as originally built, pointed or led, not to the postern in the Masjid, but to some object now not in existence, but which must have been situated somewhere near the place where the main prayer niche of the Masjid now stands; and this is rendered all the more probable, by the existence of the pedestal of some great statue, among the stones which compose the pulpit.

In short it appears, that when the Masjid was built, and the postern in the wall came into use for the Masjid, the North jamb was cut, so as to give a free entrance in the direction of the postern in the back wall of the Masjid.

Consequently therefore, that the entrance, as originally built, was built without any reference to the Masjid; and as it is simply impossible, that if built contemporaneously with, or subsequent to the Masjid, it should have been built without any reference to the Masjid, to which it would have formed an entrance; there is no possibility of avoiding the conclusion, that it dates to a time, anterior to the building of the Masjid.

And taken in connection with the larger brick of which it is built, and the mud cement in which the bricks are set, while the Masjid and its dependencies are built, of stone or brick, invariably set in lime mortar, there is but one reasonable conclusion which can be entertained; that it is a pre-muhammadan remnant. And the further inference is therefore inevitable, that there existed; first the road, along side which, was built this wall of the large Gupta bricks, during the Hindu or pre-muhammadan period, that is at some time during the Gupta rule.

Its alignment consequently, making as it does, an angle of 20 degrees with the longer axis of the Masjid, is dependent, not on the Masjid, but on the direction of the road which it faced.

As a possible, through not certain corollary, it follows, that as Hindu Temples often, and Muhammadan Masjids invariably, are aligned with reference to the cardinal points of the compass, the building, of which this existing fragment of a pre-muhammadan time, formed one inclosure wall, and was presumably parallel to it, could not have been Mahammadan, was probably not Hindu, and therefore was probably Buddhist.

And the second corollary is, that consequently, if there he no error in the argument, some Buddhist remains ought to be discoverable, in or about the place.

This proof of the correctness of the argument, is fortunately I believe forthcoming. Immediately within, and a little to the East of the West entrance of the West wall, was found the round base of some solid building, across the top of which was found running, a straight wall. As the straight wall appeared to be the wall of some kind of entrance chamber, such as usually, forms the entrance of inclosures for Muhammadan Tombs or Masjids; and as this straight wall was built of the smaller, or Muhammadan brick, the circular solid building below it, must clearly be pre-muhammadan, and consequently very probably a Buddhist Stupa, which so far as I am aware, is the only building which must be both solid and circular.

Possibly, nay probably, its square base or pedestal, still lies buried below the level to which the ground was excavated a few years ago, by order of the Bengal Government; my instructions however, during the past three seasons, did not authorise me, or my staff, to make any excavations in the Adina Masjid, though the cost of such would have been a mere trifle, probably 5 Rupees.

I would respectfully represent, in this connection, that an officer whom the Government can trust with the conduct of the archœological exploration of two provinces; and who has under a former Director General proved himself competent to carry out such extensive excavations, as were successfully accomplished, at Bharhut, in Afghanistan, at Budhha Gaya, in Rohtasgarh, and elsewhere, may, without misgiving, be trusted and empowered on his own authority; and without a lengthy reference to the Director General in each case; to make any such smaller excavation, as may appear to him desirable, so long as the funds at his disposal are not exceeded; even if the programme of proposed operations for the year, which must, from the very nature of the case, be rather an *outline of expected operations*, than a *detailed diary of actual work*, fails to make special mention or to receive the Director General's sanction to, such petty excavations.

If then this circular solid base, which can reasonably be conjectured to be a Stupa, be actually one; and, judging from the size of the bricks, a Stupa of the middle Gupta period; it must stand on a square basement, and this basement would be found built on the original level of the old Court of the Temple.

The debris removed some years ago, by order of the Bengal Government, consisted almost wholly of broken brick and mortar, as may be seen in the extensive mounds around; and it is therefore probable, that the level of the original Hindu Court, has not yet been reached; when earth, or the large Hindu brick or stone slabbing, would have been found.

The safety of the existing Masjid, must always restrict the wholesale excavation of its Courts, internal and external, to below its present level; but there is no sufficient reason, why partial exploratory trenches, to be carefully filled up again, should not be carried, across such parts of the Court, as will not, even remotely, endanger the safety of the existing buildings.

The discovery of this Stupa, is of importance; as although there never could have been a doubt, of the magnificent, deeply cut floral, and other sculpture, now to be seen in the building, dating to the Hindu period, they might, and indeed have been supposed, to have been brought from Gaur, by the Afghan Kings, who, "to build the public structures of their new capital, plundered Gaur of every monument that could be removed." (Hunter). The discovery of this Stupa however, and the evidence of the boundary wall, whose pre-muhammadan antiquity, is established by the size of the bricks it is composed of, by their being set in mud, (while all the brickwork which is undeniably Muhammadan, are set in lime mortar) and by its unconformable alignment, in regard to the Masjid; proves the existence here, of certainly one group, of pre-muhammadan temples; and relieves the Archœologist, from being constrained to admit, that the pre-mahummadan remains, now seen here, were brought from a distance.

But I will go further; while Executive Engineer, of the Temporary Division of ancient monuments, of the Bengal Public Works, I had exceptional means, not enjoyed by others, of examining the buildings, both at Gaur and at Pandua; I was not then aware of the existence, either of the Stupa, or of the wall (both then buried under 5 feet of rubbish,) but even then it appeared to me, that neither in material, nor in the forms of the floral sculpture, least of all in the persistent recurrence of the trefoil cusped sculptured arches, which form such prominently unmistakeable features of the Hindu work in Pandua, could any resemblance or connection be traced, between them, and the Hindu remains (equally utilised for Muhammadan work) at Gaur; nor, when I looked for the remnants of buildings, wholly or partially dismantled, could I see any in Gaur, that might probably have furnished the materials for Pandua; and though in my ignorance of the former existence of an important group of Hindu Temples at Pandua, I was forced to accept the statement made in the Gazetteer, of Gaur having been dismantled to build Pandua, I did so under reluctant constraint. Now however, with wider knowledge from the excavations, I no longer entertain the idea, of Gaur having been dismantled, to build the Adina Masjid in Pandua nor can I find any original reliable authority for this statement in the Gazetteer.

But the evidence in support of this new view, is not based solely on what has been said above. Among the debris, during the excavations made by order of the Bengal Government some four years ago, were found, several *fragments* of figures ; the fragments so small, that it would be absurd to suppose they were actually carted more than 20 miles from Gaur, to be put into odd corners, to fill up holes between larger blocks of stone, when whole hills of broken brick, must have been available on the spot.

Among these, in the shattered ruins of the core of one of the pillars, in the North end of one of the Western aisles, was found an inscribed fragment of the pedestal of a statue ; the inscription is given in plate 88. It is unfortunately but a fragment and gives no information. In the last line the opening letters *pta* might be the second syllable of the word Gupta of which the first syllable *gu*, has got lost in the lost portion, evidently the larger portion, of the pedestal ; but there is fortunately in the fragment, a sibilant S., the form of which, is certainly early : I should say 7th century, and by no possibility later than the 8th. Such as it is however, it is a proof, that probably in the 7th, and certainly not later than the 8th century, a Temple, in which statues could be set up for worship, existed here.

It may therefore he assumed, without any reasonable doubt, that assuredly one group of Temples, dating to the 7th century or thereabouts, (if not more than one group) stood on the site of the present Adina Masjid, and that the unconformable orientation of the West boundary wall, with reference to the Masjid, as well as the difference in the material (both in brick and in cementing material) of which it is composed, from the material used in the Masjid, are due to its having been the boundary wall, within which this group of *Temples* stood.

It now remains to ascertain, as far as may be, the size of the original inclosure.

It will be seen (Index plate) that at P., two short lines of wall, run out, at what is practically a right angle, from the line of the West boundary wall, and meet the back wall of the Masjid ; while at Q. a longer line of wall, very nearly parallel to the North face of the Masjid, and therefore presumably the North boundary wall of the Masjid, runs to, and beyond the East facade of the Masjid, on to the ghat, which leads down into the Tank marked 1.

As the average distance (at the middle) of this wall from the North face of the Masjid is 62′-0″ while that of the South boundary wall is 65 feet, it is clear, that running nearly parallel to the North and South faces of the Masjid, at about the same distance from them, and built of small Muhammadan brick set in

mortar, (though the repairs to the North wall made at some subsequent period are set in mud), they are respectively the North and South boundary walls of the Masjid.

What then is the short wall at P?

I cannot but conclude, judging from the construction of the wall, the material (large brick and mud setting) of which it is composed, and the angle (very close upon and therefore practically) 90 degrees, which it makes with the West pre-muhammadan boundary wall, that the Northern of the double line of walls at P., forms the North boundary wall of the old temple inclosure, of which P. formed the North-West corner.

How it happens that this corner escaped being pulled down, or why it was left partially standing, it is now perhaps impossible to determine, though I have guessed that this was done to inclose a Zenana Court, (see infra).

Nor judging from the irregular facing of the inner, or Southern of the two walls at P., can I assign it with *confidence* to the Buddhist period; it may be contemporary with the outer or Northern parallel fragment, and the original Temple boundary wall may have been double, as is often the case elsewhere; but I would rather not pronounce decisively on this question; all that can be affirmed with reasonable certainty is, that P. is the original outer North-West corner of the Temple inclosure, and the Northern of the double line of walls at P. the outer boundary wall.

It is necessary to add, that the portion P. Q. of the West wall, was not found intact; fragments only of the lowest courses were found, the bricks composing these fragments, were small and set in mortar.

If then P. was the North-West corner, and E. clearly the North entrance, of the original temple inclosure; assuming as is natural, that this entrance was situated in the centre of the wall, the length of this, the West face of the inclosure, would be 495 feet, or double the distance between E., and P.; and the South-West corner would fall at P′. (see index plan).

The portion of boundary wall from a point to the North of P′. to R. has been conjecturally put in, and therefore in dotted lines; no part of it was actually exhumed, nor was the corner Q′., nor the point P′. actually exhumed and seen. There is however little doubt, that if they still exist, excavation would bring them to light.

The inclosure therefore, within which the Temples of Adina stood, measured 495 feet North and South: unfortunately, there are no means of defining the extent of the inclosure, East and

West, with anything like the same *certainty*, though still with a high degree of probability.

Whether the architect, or his employer, determined the size of the Masjid, it is now impossible to ascertain; all that can be ascertained is, what the architect did; and this appears to have been what the architect did; he drew a line due North and South, within, and bounded by the old inclosure walls, and took that for the length of his Masjid.

Further it will be seen, that the distance of this, due North and South line, of the West wall of the Masjid, is not fixed at random; the line is drawn, just at such a distance from the old boundary wall, as to leave room, (1) for the so-called King's vestibule V., and (2) for a necessary closet C.; which, as an impure place, had necessarily to be kept separate, not touching the Holy place of prayer. The West wall of the Masjid it will be seen, barely leaves room for these. A further circumstance which may and possibly did determine, the position of the West wall of the Masjid, is, that in all probability, the sanctum of the temple, judging from the remnants of heavy pedestals of statues, now built into the pulpit, and the superb canopied trefoils, now doing duty as prayer niches, stood where the main prayer niche now stands; nothing would probably so tickle the fancy of a bigot, as the power of placing the sanctum of his orthodox cult, (in this case the main prayer niche) on the spot, where the hated infidel had his sanctum; and utilising to the honor of his own religion, the very canopies of the idolatrous statues; for there is no doubt whatever in my mind, comparing these trefoils with the recently discovered similar trefoils at Kylas over figures of Parvati, (see report Part I of last year) that these trefoils are really the canopies over the statues, originally inshrined here.

Further it will be seen, that the postern D., is brought up, as close as possible, to the main nave; it obviously could not be put within the nave, but it was at the same time, necessary to bring it as close to it as possible, so as to nearly face the existing old entrance E. in the existing ancient inclosure wall; and this probably for the reason, that this entrance, which, as now seen, is merely a bit of brickwork, was then, an elaborately adorned stone faced gateway, of which, now, the stones have disappeared.

That many stones have disappeared from the Adina Masjid, may perhaps best be conjectured from plate 31 Ravenshaw; the door lintels there shewn, or others similar, (for the Photograph is not quite clear enough to enable the point to be exactly determined) are now in the India Museum; and I have myself

seen, in the compound of the then magistrate of Malda, the late Mr. Porch, a set of lintels obtained from Pandua, which he, when going on his last furlough, packed up and carried off to England.

But if, as appears now certain, the procedure adopted by the architect, was to fill the old court, as regards the direction N. and S. with his Masjid, it is not improbable, that a similar procedure was followed, in regard to its breadth East and West.

And this is rendered all the more probable by the circumstance, that if the temple inclosure were an exact square, in accordance with a widely prevailing custom in Banga, (as contra-distinguished from other parts of India) of which examples enough may be found in Montgomery Martin's (Buchanan's) Eastern India, and a square on the now ascertained ancient West side P. P'. be described, as done by the dotted lines P. P'. P''. P''', the South-East corner of the Masjid, also falls, close enough to the line of walling, so conjecturally drawn, to justify the inference, that thus also was the breadth of the Masjid determined.

Of course it is obvious, that one corner of the Masjid, if so drawn, must necessarily fall beyond the old inclosure, but it will be seen, that under the conditions already detailed, the maximum of size for the Masjid, has been secured, by the arrangement adopted.

I accordingly conclude, not indeed as certain, but as reasonably probable, that the ancient Temple inclosure, was, more or less, (due to architects errors of setting out and construction) a square of about 495 feet side.

How many Temples stood within it, is a more difficult question to answer: five stone carved door frames, and one plain stone gateway, now exist in the Masjid as doorways; the jambs of one appear to have been utilised in the upper horizontal sculptured stones, over the central prayer niche in the nave, and I am aware of two, which have assuredly been removed; besides these, the stone sculptured pillars ornamenting the niche N. (see plate 23) appear to me to have belonged to a doorway of a subordinate Temple, as the very figures (flying figures) projecting from the sides of the jambs, which invariably occur in the earlier Gupta doorways exist, sadly mutilated it is true, but unmistakeable, as well as the lower figures at the sides, once hidden away by the Muhammadan architect behind a smooth facing in the spaces S. S., (pl. 23) but now exposed. There is consequently indisputable record of 10 doorways; and as each Temple must have had 4 doorways, supposing it to have had a sanctum as well as the outer Hall with a door in the sanctum, one in the front and a door at each projecting cross limb of the transept, (the maximum number in a complete un-

altered large Temple) there must have been at least 3 Temples; but as several door frames have probably got lost, beyond record, it would not be an extravagant estimate, to assume 9 Temples (a common and favorite Hindu number, the *navaratna*) as having been destroyed, to build the Masjid; that is a great Central Temple, 4 Subordinate Temples facing the four sides, and 4 Subordinate Temples opposite the 4 corners of the great shrine. In any case, the least that can be estimated, is 5 Temples; *viz.*, the great central shrine, with a Subordinate Temple facing each side; also a favorite number (the *panoharatna*) with Hindu architects, as having been destroyed to build the Masjid.

I have not included the cusped trefoil sculptured arches of the prayer niches in the nave, as having formed doorways; because, as has been already mentioned, there is reason to believe, that they were not doorways, but the ornamented canopies, over the statues that were inshrined, in these Temples.

There cannot, it appears to me, now, exist any reasonable doubt, that the Adina Masjid occupies the site, of a once famous, or at least a most important, and highly ornamented, pre-muhammadan shrine; but as collateral evidence of it, may be added the circumstance, that at certain times of the year, not only Muhammadans, but Hindus also in large numbers, flock in pilgrimage to the Masjid; and this Hindu pilgrimage, is probably a relic of the pilgrimage made by their ancestors, to the demolished Temple.

But if the Adina Masjid occupies the site of a Hindu (pre-muhammadan) Temple, may not the name itself be a reminiscence of the original name? I am aware that Adineh means Friday, and the name Adina Masjid has been taken to mean. "Friday Mosque" but on the face of it, the explanation is as unsatisfactory, as it would be to call a church the "Sunday Church," as necessarily all mosques, are in fact, "Friday Mosques;" further, the name, is not Adineh, but Adina. I would preferably, remembering that the sculptures (as will be shewn further on) prove the Temple to date to the 7th century, connect the name, with Adisur, and I would connect Adisur with Aditya Sena Deva, as an alias.

It is well known that the various Gupta Kings, both before and after Aditya Sena Deva, assumed (or the people gave them) various titles; there are no such for Aditya Sena. What more likely than that, in recognition, or as a mark, of his Hindu orthodoxy, the Great Aditya Sena should have been also known as Adisur? No King equal to him in power, had sway over Bengal about the period which tradition would assign to the Adisur who reformed the religions heirarchy of Bengal, nor is it any way possible to ignore the universal tradition of Adisur, as a King of Bengal

and as the King, who went the length of importing learned Brahmans from Kananj, to reform the effete Brahmanic heirarchy of Bengal, while the known and staunch orthodoxy of Aditya Sena Deva, as well as his undoubted vast power, must point to *him*, more than to any other king, as the one, who, with the *power*, was at the same time, the only one, with any probability of possessing the *will*, to introduce such a gigantic reform into his eastern provinces, and who, above all others, would merit the title of "Sura" to his name—just as in this very part of India the anonymous title of "Asura" has been attached to the similarly great Raja Bana, whose traditions are current all over the surrounding districts, and who is universally in this part of India, and even as far as Gaya known as "Ban Asura." In short as a purely speculative, but nevertheless most probable theory, I consider, that the Adisur of Bengal tradition, is no other than the mighty Aditya Sena Deva of the Gupta dynasty; and consequently, differing from Cunningham in some other points, I agree with him, that the Senas of Bengal, are the direct descendants of this great king, who, as is only too common in Hindu dynasties, probably at his death, parcelled out his mighty empire among his sons.

And this inference is borne out by the circumstance, that Aditya Sena's son and successor, in the kingdom of Anga, (and Suzerainty of Magadha and Bengal) did not by far, approach his father in regal power, a circumstance easily accounted for, if the province of Bengal were assigned to another son, leaving only a nominal Suzerainty to the successor of the great Aditya in Suzerain power.

Further, as I have in a previous report pointed out; quite independent of the questions now being discussed; there can be no reasonable doubt of Aditya Sena (and the Gupta dynasty in fact) having belonged to the lunar race. I see the learned Dr. Rajendra Lala, on the strength of inscriptions, concludes that the Senas of Bengal belonged to the lunar race. How in face of this, and the sum of the other probabilities, all tending in one direction, can the supposition be set aside, as unworthy of being brought forward, (even if it be for adverse discussion merely) that, (1) The Senas of Bengal are the descendants of Aditya Sena Deva, a supposition wherein Cunningham and Rajendra both support me.

(2). That the Senas of Bengal belonged to the lunar race, in which I have Raja Rajendra's support.

(3). That the Adisur of Bengal traditions, is no other than the great Aditya Sena Deva.

The elucidation of truth is the object of all research, and this must be my plea for bringing into prominence, not for adoption without examination, but for discussion, with a hope of final adoption, what is supported by the entire weight of probability, so far as present Archœological research goes.

My difficulty lies not here, but in quite a different direction. It is impossible to ignore the existence of that solid round building S. near the West wall of the Adina Masjid, nor do I see how it could have been anything but a Stupa; if so, how could Aditya Sena Deva or Adisur (as I must now provisionally for Bengal, call him) orthodox Hindu as he was, have built the temple? If he did not, could his son or his grandson have been Buddhist, and built it? Later than this, it is not possible to bring down the date of the Temple.

Where was Aditya Senas' capital? he could scarcely have dwelt in Anga, except as Harsha Varddhanas vassal, and this, Hiouen Thsang's silence renders improbable. Was it then that his capital was at what is now known as Pandua, *but whose ancient name was some derivative of Adisur, of which a reminiscence is preserved in the name Adina, of the Masjid, which stands, where his capital once stood?* Was he compelled during Harsha Varddhanas' reign to conform to Buddhism, and to build a grand Buddhist Temple in his capital, to save himself from deposition or death at the hands of that zealous Buddhist? and may his subsequent excess of zeal in orthodox Hinduism, and his grand reform in the Bramhanical heirarchy, as soon as Harsha Varddhanas' death, left him freedom of choice and power, be, but the natural reaction from an enforced profession, of a faith he could not sincerely believe in? The questions are of great interest, but at the present stage of research I connot presume to reply to them with assurance; I can only say, that my own convictions would lead me to answer the queries in the affirmative.

It is but fair to add, that I believe it is the opinion of the present Director General, that the circular basement, S. alluded to, (Index plate) is not a Stupa; could I agree with his view, or should exploration prove my suppposition, of its being a Stupa, wrong, all my difficulty would vanish, and the Temple, which once stood within the inclosure, would be a Hindu not a Buddhist Temple and therefore most appropriately built by the great Hindu King Aditya Sena Deva.

The circumstance of its not having been aligned North and South or East and West would be no difficulty, as although the cases are rare, there are not wanting instances, of such irregular alignments, in Hindu Brahmanical Temples.

It is also fair to add that the opinion of the draftsman of the Survey, Babu Rajmohan Banerjya, who has minutely measured the Masjid, and by whom every plate which accompanies this report has been both measured and drawn, is adverse to my view, and agrees with the opinion of the Director General in regarding the basement S., as *not* a Stupa; his idea that it was a *well*, and the conjecture of the Director General that it is the base of a minar, appear to me however to be both rendered untenable, by the *fact* which no theory can ignore, (1) of a straight wall having been built across it as shewn by the dotted line L. L. a wall actually seen in situ by me personally during the course of the excavations before it was necessarily dismantled and removed; (2) by its standing absolutely straight in front of, and in the direct line, from the entrance in the inclosure, to the postern D. in the Masjid.

At the same time, in adverse evidence, to these temples having been Buddhist, is the actual existence of an Argha (the Sistrum for the round ended cylinder which is the Hindu phallic emblem), actually lying in the East cloisters, and evidently fallen out from the obscurity, into which the Muhammadan Architect had built it in, and the existence of the corresponding cylinder for it, now strangely enough, occupying a prominent position, (not however as a symbol of the Divinity, but as an ornamental finial, and laid horizontally, with its rounded end jutting out boldly) in the inner end, or West wall, of the great nave at L. plate 12. I have carefully examined this stone, with the aid of scaffolding, and so has Babu Rajmohan Banerjya, the draftsman, and we agree in considering this stone at L., to have been originally a lingam, and probably *the lingam*, which was inserted into its place in the *sistrum already noticed.*

The existence of these indubitable proofs, of the temples having been, certainly at some period Brahmanical, cannot be ignored, any more than that of the Stupa, supposing the round basement turns out to be a Stupa.

In this case, it would absolutely compel the inference, that the Temple was at one time Buddhist, at another Brahmanical, while its material new forms a Muhammadan Masjid. What strange vissicitudes these stones have gone through!

The present North and South boundary walls, are aligned roughly East and West, there being a small error in each; in the former of about 3′ in the latter of 4½ degrees, assuming the longer axis of the Masjid to be correctly aligned in the meridian; this however is not the case, although the error here was not accurately determined. The error of 4½° is not however an error of carelessness, but rather a deviation, *forced* on the archi-

tect, by the existence of the tank 2; to which is also due, no doubt, the difference in the distances from the Masjid, of the North and South boundary walls.

It may however be accepted, that the architect, in setting out the long lines, did his work so carelessly, or his instruments were so defective, that he was liable to errors of about 3 degrees. Taking into consideration the care with which his levels are all set out, as well as the greater correctness of the lines of the Masjid itself, I would rather assign this error to carelessness in setting out, what he knew to be unessential parts of the great building, than to any special defects in the instruments he employed. In the Masjid Court, the difference in measurement of the two diagonals amounts to nearly 5 feet, of which a foot may be due to the unequal stretching of my own measuring tape, leaving 4 feet as the measure of the error of the architect.

The more ancient Hindu architect, also appears to have been in error, in setting out his right angle at P., (the only one now existing to check his accuracy of execution) by as much as one degree. An amount, which, though small as compared with that of his Muhammadan successor, is nevertheless according to modern requirements, too great, to be ever permitted by a modern architect.

Of the tanks which surround the Masjid inclosure, it appears to me that tanks 3 and 4 are undoubtedly Muhammadan, dug in all human probability, to furnish the earth for the bricks, of which the Masjid was built, as also tank 5; but tanks 1 and 2 are certainly Hindu, not only because the position and direction of tank 2, appears to have forced on the later Muhammadan architect, his deviation in the correct alignment of the South boundary wall; but, as regards tank 1, because, descending down this tank, was found, during the excavations, a flight of steps, built of the older Hindu brick, and set in mud; and not only were the steps alone thus found, but a fragment of the upper flooring, of the platform of the tank Chaubutra, was also found intact; furnishing thus, not only an indication of the age of this tank, but further, supplying definitely, the level of the Hindu Court, or rather of the grounds just outside the walls of the Hindu Court.

This level which nearly coincides (it is only about $1\frac{1}{2}$ feet lower) with what the outer offsets of the plinth of the East wall of the Masjid (not shewn in the drawings) as well as the undisturbed surface of the ground outside at West shew to have been the original levels of the Muhammadan Court at the East end, is considerably lower than the level of the Court near the West boundary wall; whether this difference, 7 feet, is a difference

which also held in the original Hindu Court, or whether a part, and if so what portion, of this difference is due to the Muhammadan Court being left, and the Masjid being built (necessarily perhaps on account of the debris of the Hindu Temple, the removal of which would have been expensive) in that part, on a higher level, at the West end, where it overlapped or overlaid rather, the foundations of the Hindu Temple, excavations can alone determine; what is known is, that the level of the floor of the East cloisters near the gargoyle, is 4′ 6″ feet lower than the level of the floor of the central nave of the Masjid, the difference of level, being to all appearance intentional, to secure efficient drainage.

The materials employed in building the Masjid, may, at the outset, be divided into stone, brick, lime, sand, clay, timber, iron, copper, glazed tiles, and colors.

The stone used is of four kinds. One, a uniform, close grained stone, full of very minute air holes, somewhat resembling laterite, but much finer grained, and of a dark grey color, approaching a dingy black: this is used in the West wall of the Masjid, both internally and externally: internally, except in the nave which is of the smooth basalt, it is used up to the springing of the arches; externally, the entire West facades with the exception of the projecting Royal Chambers, and the two posterns, which are also of the smooth basalt, is, up to a height of 11 feet throughout above plinth, as well as the entire plinth, and the foundations of all the Towers are built of this stone. Portions of the North and South outer walls, are also built of this stone, to varying heights. The stone appears to me to be of igneous origin, and not to be a real laterite; I have not been able to ascertain the quarries whence this was obtained, but as stone like it, is to be found near Maharajpur, and elsewhere in the Rajmahal Hills, I have little doubt they were obtained from the vicinity of Maharajpur; the more so, as the Ganges, at the time the Temples were built (the demolition of which supplied the Muhammadan Architect) undoubtedly ran down the numerous channels, which still branch off the North bank of the Ganges, at Sikrigali, and flowing past old Malda, and the East of ancient Gaur, re-entered what is *now* the course of the Ganges, about Godagari; (see part I report), thus furnishing, easy down-stream water carriage, certainly down to Malda; and thence probably, carried up the Mahananda, to the point opposite the Adina Masjid, where; the existence of an artificial sheet of water nearly a mile long by half mile wide, proves it to have once been a place of note; the last four miles being accomplished by land carriage (see Indian Atlas Sheets 112, 119,) it is worthy of note that a village adjacent is named Bangabari.

The second kind of stone is the ordinary granite; this occurs sparingly; chiefly in the shape of beams to support the

floor of the Royal platform, but also in parts of some of the niches, below the King's platform, in some of the pillars, in most of the pillar bases, in the larger doorway jambs and lintels, and occasionally, elsewhere, along with the other kinds; the stone however does not appear to have all been brought from the same quarries, as the grain of the stone, varies from coarse to fine.

The third, I take to be a kind of dark grey sandstone, used chiefly in the niches which are not built wholly of brick, but occasionally also elsewhere; this is a comparatively soft stone and flakes off from the action of saltpetre.

Lastly is the fine, very close grained, blue black basalt, which is used for all the fine sculpture, for the flooring slabs of the kings' platform, for the smaller doors, for the prayer niches, for the shafts of the pillars, for the interior cornicing of the great vault, for the facing of the West wall of the vault to nearly its full height, for the whole of the external mouldings and walls, up to the platform level, of the king's chamber; for the lowest storey of the corner towers, for the pulpit and stone work in the great nave, for all the elaborate sculptures, and elsewhere; this stone is used in various degrees of fineness of chiselling, from the polished door jambs, and sculpture, both Hindu and Muhammadan, and the polished, fluted pillars, of the Royal platform, to the coarsely chiselled segmental pieces, which composed, and compose, the shafts of the ordinary pillars, fallen as well as standing.

From where stone No. 3 was obtained I cannot conjecture, as I have not seen similar stone in the Rajmahal hills any where near Sikrigalli, whence the other stone was assuredly obtained, but the stone No. 2 as well as the blue black basalt, erroneously called black marble by Francklin, were undoubtedly obtained from the quarries near Maharajpur, where they, or at least the blue black basalt, is found in abundance, and is to this day, dug out, and broken up, into railway ballast; the walls of the fortress of Terriagarhi, (which by the way should be Teliagarhi the name being obviously derived from the "Telia" stone the native name of this black basalt) are built mainly of this stone, and although the quarries now worked, yield only detached rolled boulders, imbedded in a red, ferrous, gravelly matrix, I am, in face of the large slabs, beams, pillars, door sills, and jambs, and squared blocks to be seen in the Adina Masjid, and in the walls of the Teliagarhi fortress, led to believe, that it is rather by preference, that the quarries now worked, are only those, which yield rolled detached boulders, easily broken into ballast, than because quarries, yielding larger stone, are not to be readily found, if need were.

Naturally all these stones would be conveyed by water carriage, as detailed in the case of the stone No. 1, to the site of the works.

Not a single piece of stone of the enormous quantity used in building the great Masjid, appears however to have been quarried by the Muhammadan Architect for his Masjid; every single piece of stone there used, has been taken from a previous existing building, and no doubt from the Temple of Aditya Sena Deva, whatever it may have been, Buddhist or Brahmanical Hindu. The door jambs, and such slabs as bear on one face Hindu sculpture, (turned inwards by the Muhammadan architect, but now exposed to view by the vissicitudes to which his work has in its turn been exposed) are obviously and undeniably Hindu, but beyond these, the floor slabs, plain polished blocks, and pillar bases, are also proved Hindu by occasional masons marks in the mediœval or Gupta characters, while even in the stones rough chiselled by the Muhammadan architect, to form the shafts of his pillars, or of his corner towers, the difference of finish of the chiselling, which fits it for the place it now occupies (or occupied) in the Masjid, from the earlier Hindu much finer chiselling, whenever, as is frequently the case, any portion of such chiselling remains, shews, that even the broken and irregular fragments, used to eke out odd gaps, were plundered from older buildings.

The bricks used are of 3 kinds (1) the large $12 \times 10$ and $10 \times 8$ brick of the older or Gupta Temple, now mainly found in the West boundary wall, but occasionally also elsewhere and in broken pieces found all over the grounds. (2) The small brick, only $1\frac{1}{2}$ inch thick, evidently burnt by the Muhammadan architect for his Masjid; of this brick the main body of the building is built. (3) The wedge shaped brick used only but not invariably, in the arches and domes and presumably burnt by the Muhammadans.

Besides these, are the ornamental bricks, these are of varying sizes, to suit the patterns, and seem to have been stamped and burnt on purpose, for the ornamental work; but the whole of the ornamental work, is not made of this brick, only portions, which will be detailed in their proper place.

All these bricks, are made of clay, finely tempered, remarkably free from grit, and although there is unmistakeable evidence of their having been ground moulded, the edges are sharp and square, and one surface at least smooth. The slightly varying thickness of bricks, of the same size in length and breadth, leads me to the inference that the moulds used, were of wood, and not iron faced, and that the variation is thickness in due to the gradual wearing away of the moulds.

The burning was no doubt done with wood for fuel; the bricks are almost all under-burnt; few and rare are the pieces of vitrified brick to be seen in this vast building; but though under-burnt (that is the heat carried to a point to burn the bricks to an orange red in general, and in many instances to a yellowish orange and not to the harder purple) the burning has been carried quite far enough, to render the bricks proof against the weather; while, whether due to the stiffness of the clay, or to the under-burning, or as may more reasonably be concluded, to both; the bricks possess a toughness, which the modern highly burnt brick does not possess.

Naturally with a stiff clay containing little admixture of sand, the drying and burning would be a very delicate operation, to avoid splitting; and the under-burning is therefore not a defect due to the use of wood fuel, (and of that even, according to modern practice, an insufficinat quantity) but rather an excellence, intentionally and deliberately aimed at by the architect, and in great measure successfully attained. The excellence consists in this, that the moderate firing which has been employed, has enabled the architect to use a clay so stiff, with such small admixture of sand, as would have been impossible to use with a more violent and thorough burning; with the result, that (1) the bricks are not too hard to cut into ornamental work wherever necessary, (2) that the bricks containing almost no sand, are highly compact and non absorbent; resisting, far more effectually that the highly sanded brick, which the modern system of high firing compels modern builders to use, the slow destruction from absorption of, and subsequent crystallization of, saltpetre; (3) that the khoa from these bricks, when mixed with the proper proportions of lime and sand, is more effectually consolidated in the ordinary Indian process of beaten terracing, into a solid mass of impervious surface; which, as may be seen in almost any part of the ruins here, holds together and behaves as a homogenous solid; supporting itself, in sheets and slabs of great size, when the supporting arch, beam, (or other support) has fallen.

The only disadvantage attendant on the moderate burning is the less capacity of the brick to crushing, but as will be seen, the maximum crushing force to which it is subjected is so small, that, used as it is, this disadvantage is nullified.

The lime employed appears to be the ordinary nodular lime obtained from Kankar containing about 30 per cent. of foreign matter chiefly alumina. Kankar is obtainable in unlimited quantities near Rajmahal, and all the way along the Ganges, but it appears that the Kankar used in the building was obtained from Sahebganj, where even now, it is obtainable more easily and

cheaply, than in any other place equally well situated with regard to the Masjid, in respect of carriage. I am not aware of any quarries whence Kankar could be obtained nearer to Adina, I have heard vague rumours that it is obtainable at Gajol on the Dinajpur Road and at Dingra on the Mahanda; but when it was in contemplation to conserve this building, (I being the engineer in charge,) I failed in procuring any from these places, and was obliged to contemplate bringing it from Sahebganj during the rains, when alone *in these days*. it is possible for boats to come down with the current to Malda, the remainder of the distance being partly up stream by boat, and the last 4 miles by land carriage.

There are quarries of a variety of lime stone at Patharghatta, near Kahalgaon, but from the remains of fragments of the unburnt lime stone, in the concrete used in the building, it does not appear to have been used in this Masjid, at least as a cementing material. It is however probable, (but on this point I would not like to give a decided opinion not having subjected the material to rough analysis) that the fine coat of lime smoothing, on which is cut the beautiful interior ornamentation of the spandrils, and jambs of arches; and the interior surfaces of the domes; was in this finer and purer lime. If so the Patharghatta quarries, where alone it is obtainable, must have been used to obtain it.

The sand used is rather fine grained, with only a slight yellow tinge, I believe it to have been obtained from the upper reaches of the Mahananda near Barsoi and Dingra, where, in making arrangements for the contemplated (but never carried out) conservation, I ascertained such sand to be obtainable in abundance in the river bed. Of course water carriage would be available the whole way except the last 4 miles.

The sand is used mixed with lime as mortar. Wherever a fine mortar was needed, this was used, the lime (omitting its impurities in combined clay) being in the proportion of one to one in the mixture. Of clay and sand, as the Kankar of which the lime was made itself contained 30 per cent. of clay and foreign matter, it is evident, that the proportions practically used in the mixing of the mortar, that is equal parts of lime and sand, gave in reality, a mortar, wherein 75 per cent. (as analysis shews) of foreign matter to 25 per cent. of real lime prevailed.

But where thick joints occur, especially in the rubble stone masonry, the mortar appears to have been mixed, with varying proportions of pounded brick; the brick however was not pounded fine, as in the modern Surkhi now universally used in India, but rather coarsely crushed into a sort of grit, of $\frac{1}{4}$ inch to $\frac{1}{2}$ inch sized fragments.

In the concrete however for roofs and floors, and in all places where beaten concrete is used, as in the covering coats of parapets, cornices, &c., a much larger proportion of broken brick, and these again of a much larger size, was used ; but the concrete not having been subjected to rough analysis the proportions used cannot be accurately defined.

Clay is used as cementing material only in the West boundary wall and in almost no other portion of the Masjid ; but the later buildings, tombs, walls, &c., built subsequently (and being built on the fallen rubbish of the Masjid, obviously dating to the period subsequent to the neglect and decay of the Masjid) to the partial ruin of the Masjid, were during the excavations, found to have been built of brick and mud ; notably was this the case with the so-called tomb of Sikandar Shah, the founder of the Masjid, which was not only built of *broken brick* and *mud*; plastered over, but was actually found built on the debris of the fallen domes of the chamber wherein the tomb stood.

Glazed tiles, colored yellow, blue, green, red, purple, and black ; were used, but used sparingly in the Masjid ; the blue is rather a bluish green ; the yellow appears to have been of two shades, a pure light yellow, and a buff; the purple is a dark purple ; the red appears to have been of two shades ; as also the black, though this may be rather due to the weather toning down the darker black to a dark ash.

The glazed tiles had the patterns, inscriptions, or flowers, as the case may be, drawn and colored on them before burning in., the patterns are not obtained, as in some instances in Gaur, and elsewhere, by the arrangement in patterns of uniformly colored tiles, cut or moulded to shape, to fit the patterns, but apparently by first laying out the needful tiles, and drawing the pattern or inscription on them in the proper colors, and then burning the colors in. What the material of the colored glaze and the colors are, I am unable to state.

Apart from these colored glazed tile decoration, there is proof of color having been used in the interior decoration in two ways :—

(1). A water color used in painting the interiors of domes, and perhaps elsewhere, over plastered and lime smoothed surfaces ; the only existing colors of this class, are, a dark red, (red ochre) a purple, a black, and a yellow.

(2). A thickish coat, laid perhaps on the relief surfaces, and certainly within the recessed surfaces, of the sculptured stone work.

In this last work the colors used, of which traces still exist, appear to have been a bright green, a blue, a purple, a vermillion, a

dark red, a yellow; there may have been others which have left no traces.

As may be inferred, the traces left of these colors, are exclusively in the recessed surfaces; and even here only in sheltered corners.

The colors were laid on of an appreciable thinkness, so far as may be estimated from the scanty remains, and of about the thickness of ordinary stout drawing paper.

The green is verdigris; the blue ground ultramarine of a cheap and inferior quality, still common in the Indian Bazars; the bright red, is vermillion; the dark red probably iron, or the common red ochre of the country; what the yellow and the purple were made of, has not been ascertained.

Timber was used certainly for the doors. Though none are now left; the socket holes for the door pins to work in, are of a size to prove that the projecting pins, on which the doors were pivoted, to work in the sockets, were of wood, and probably in one piece with the door: judging from these socket holes, the doors, if of planks or battens, or the frame work of the doors, if they were framed and panelled, were two to two and half inches in thickness.

Judging from the holes yet existing to receive the sliding bars, by which the doors were shut, these bars also appear to have been of wood.

But the most curious use of timber appears to have been in the roofing: strange as it may appear, while there is no room for supposing, that a single piece of timber, was used in the entire vast building as a *beam*, there is the most irrefragible proof of timber having been used as a *wall plate*, for *the main vault to spring from.*

Broken and dismantled though it is, enough of the lowest portions of the vault remains to shew, that it sprang from a rectangular beam about 12 × 10 inches laid in a channel in the masonry in which it was imbedded. The wood has decayed and disappeared long ago, but the empty channel near the springing (with in places a crumbling woody powder now in it) as well as the hole into which the beam end was inserted in the inner face of the West wall of the nave (see plate 94) still exists.

What the wood was which was used in the Masjid, is more difficult to ascertain; as the Masjid was built in A. D. 1307 and as in those days the use of immature sal timber (now so common and due to the exhaustion of mature sal to supply railway demands) had presumably not been necessitated, the timber, had it been sal, would scarcely have now totally disappeared; instances being common, of sal, lasting more than 580 years; nor could it

have been teak, which judging from the Western caves, is of even longer duration ; I infer consequently, that some local wood, more easily rotted or attacked by white ants, was used, and probably played no unimportant part in the downfall of the vault.

Iron was occasionally used in binding together with cramps, the stones which were used to build the pillars, but its use in this position as also elsewhere in the shape of cramps was not profuse ; it was however largely used, manufactured into coarse long linked chains.

No less than 3½ maunds of fragments of such chains, in the shape of broken links and rings were found in the debris during the excavations undertaken 4 years ago, and I infer, that the links picked up, are the broken links of chains, which were hung from the crowns of the domes to bear lamps.

Every dome had not a chain, but whether only one, or more than one dome, in each aisle, had a chain it is of course now impossible to guess ; I rather think one dome in each Western aisle, and one dome in each file of the cells, had a chain hanging from its crown with a lamp at its end.

The lamps appear to have been of both iron and of copper, as curved pieces of both iron and copper which can be regarded only as fragments of lamps, have been picked up in the debris. No other use of copper in the building appears to have been made.

These materials are all that are used in the building ; there is however, or rather was, one solitary specimen of "gold stone" inserted in the back wall of the Masjid high up, with the fish symbol and the "Bismallah ul rahman ul rahim" sculptured thereon in relief ; this stone which I saw and touched in situ in 1883 is now however gone.

The materials above described, are all used in the Masjid, in its various parts as already detailed, and the quality of the work executed, depending partly on the material and partly on their mode of use, naturally varies greatly.

The main work as may be conjectured is masonry of brick and of stone.

The stone masonry so far as can be judged from the portions of interior work displayed by ruinous portions, appears to be very inferior. There is, where stone alone is used, a facing of carefully cut and fitted ashlar work, with joints as fine (perhaps finer) as the best ashlar masonry of the present day ; but this exquisitely surfaced ashlar work, hides work of the most perfunctory character ; behind this beautiful face work, comes a mass of rough rubble masonry, built of boulders and fragments of all shapes and sizes : not only in the thick walls, but even in the

slender pillars, has this sort of work been permitted; boulders and fragments, smooth rounded, or rough and angular, are, to all appearance, thrown in without the slightest regard to bond, and the gaps filled in with a concrete.

The procedure, as disclosed by the broken parts, appears to have been to build; in the case of walls, the two faces, in the case of pillars the smooth round outer shell, of stone carefully cut, and set in a fine mortar of lime and sand; the courses being alternately, of stones laid with their largest dimensions horizontal, and of stone with their longest dimensions vertical; when the outer fine shell had been carefully fitted, the space within appears to have had a concrete of fine brick gravel and mortar, thrown in by the basket load, into which rough stone, without any regard to bond, was then imbedded, so as approximately to fill the core; and more mortar then laid on plentifully and grouted into the joints, bringing the inner core roughly, and roughly only, to the same level as the top of the course of outer fine ashlar work; then a second layer of ashlar stone, but this time a mere veneer, that is the stones with their longest dimensions vertical, were carefully fitted and set in fine mortar as before, and the hollow core filled in, precisely as in the case of the previous horizontally laid course; naturally the strength of the wall, (or pillar) was, with this mode of construction, not the strength of the ashlar facing outside, but of the rubble core inside.

The brick work is rather better built. Mainly because the material being small, it was not easy in arranging the brick, to leave such large gaps as with rubble stone, but nevertheless the work is not what the much maligned modern Indian Public Works Department, would for an instant permit: here as in the stone work, the face work is built of brick carefully set, and even more carefully, surface smoothed; but behind this outer, fine, but thin facing, the bricks are set with no regard whatever to joint or bond; while every piece apparently, which the masons found within reach, broken, vitrified, under burnt, or good, was indiscriminately and impartially put in: the excellence of the mortar, has however welded the core, and the fine facing, into a solid mass in most places; nevertheless the facing does occasionally flake off, or bulge out, as may be seen in plate 89. It is clear here that however caused, the outer fine shell has separated, (flaked off more correctly describes the case) from the rough inner core.

The joints in the face work, are as fine as in fairly good modern brickwork of the present Indian Public Works, occasionally finer; but in the core, joints over an inch thick, are common, and more especially in the vertical joints, where indeed it is the rule rather than the exception.

The work in the arches is however much more carefully executed; the arch rings are from 15 to 22 inches in aggregate thickness, varying according to sizes of the arches; the joints are fine, and great care has been taken, both as regards the radial joints, and the cross bonding. The only fault which can be found with the arches is in the keystone; naturally with lancet shaped arches, and radial joints, there will be left a great triangular space at the crown; this has not been filled in with such care as it might have been, but appears in every case to have been rather rudely filled in solid, without any particular care as to the direction of the joints: the mortar and the rest of the arch work however, is so good, that even where, as has happened in the great majority of arches, the key bricks have partially decayed, or fallen out, the arch nevertheless stands safe.

Among other places where also special care has been taken with the brick work, are the corbelled pendentives; here the courses are carefully bonded into the backing, and though, as may be seen from the plates, the pendentives are of the simplest description of mere corbelled out work, they have supported and still support the domes above.

The brick work of the domes, (they are all of brick) is also carefully executed in the interior surface of the dome, but outside this, the bricks are set without any regard, to bond or fineness of joints, though the radial direction of the joints is roughly preserved to some extent; the exterior surface of the brick work of the domes, which are altogether 13 inches thick, wherever laid bare by the destruction of the plaster, shews exceedingly rough work; but a dome once built with its one innermost hemispherical shell carefully arranged, is so safe, that almost any amount of rough work can be indulged in in the outer layers. It needs to be added, that, a thick layer of beaten concrete, (10 inches thick) effectually prevents any access of water to the rough and rather loose brick work of the outer layers of the domes, and prevents leakage.

The brick work in the cornicing, is also exceptionally good, and indeed, seeing that the main cornice projects no less than 12 inches from the face of the wall and is wholly composed of ordinary small bricks, it was simply imperative, to put in here, the best quality of material, as well as the greatest care in execution.

In the ornamental panelling or rather filling of the lancet shaped space, between the springing line of the arches and the arches, as well as in the various brick niches and panelled ornaments, the face work is very carefully executed, but the backing is, as in the case of the walls,, rough work. The bricks of the

ornamental work are of varying sizes to suit the particular requirements in each case or class of work ; they are in many instances, merely a vertical veneer, the bricks being stuck on with the larger dimensions vertical, to a thick backing of mortar : in a few cases where the pattern admits of it, the vertically stuck on bricks alternate with bricks laid horizontally, whose *ends* are cut into and also in some cases were moulded into ornamental patterns : in the panels and cornices both varieties of work are to be seen.

For a detailed statement of the employment of these ornamental bricks in the panelling and ornamental work in corbels, freizes, cornices, &c., see appendix I.

The brick lattice work is also carefully executed.

But in all other places, not being face work and not specially mentioned, the work is very coarse and careless ; thick joints, absence of bond, and indiscrimate use of bricks of all sizes and qualities, so as to fill the given space, are the characteristics.

The brick work appears in every case to have been covered with a layer of plaster, or concrete, or lime smoothing and I could not, (and here Babu Raj Mohan Banerjya the draftsman, who in measuring the building in minute detail has necessarily scrutinised it even more carefully than me, agrees with me) find a single instance in the entire building, where the naked brick surface was exposed. The covering coat, as regards domes and roofing, is a layer, varying from 8inches to 20 inches. (10 inches over domes 8 inches to 20 inches over flat roofs and of 8 inches to 12 inches over floors) of beaten concrete, with a thin layer $\frac{1}{2}$ inch of beaten fine plaster on top smoothed down.

The bases of the foliated caps were also of concrete ; what the caps themselves were made of, as none exist, it is now impossible to ascertain.

As regards flooring, the brick work was covered by a layer of beaten concrete, about 12 inches thick, overlaid by a fine surkhi coating about $\frac{3}{4}$ inch thick with just a thin layer $\frac{1}{4}$ inch of lime smoothing beaten on and smoothed. The surfaces of walls where plain, whether of stone or brick (except polished stone) appear to have had interiorly a coat of $\frac{1}{8}$ inch of lime (not lime and sand) smoothing, while exteriorly, I have, from the few traces that exist, come to conclude, that not only the brick work, but the whole of the stone work, except the fine, almost polished basalt work, had a coat of nearly $\frac{1}{4}$ inch of lime and sand plaster laid on and smoothed off, with an extra $\frac{1}{4}$ inch coat of fine lime smoothing (without the sand) in the mouldings, cusped arches and other ornamental parts.

The fine basalt work outside, where plain, (I suspect, but am unable to prove by remains) had a thin coat of fine lime smoothing only, laid on; the only places where they occur, are in the corner towers, and the *basement* and basement only, of the King's Chamber; and the exceptional and violently contrasting and incogruous appearance of these isolated pieces, if left naked, as against the whole of the rest of the outer (and inner too) surface, compels me to suppose, in the absence of positive evidence to the contrary, and in order not to convict the architect of inconsistency, that they were also covered with a fine coat of lime smoothing, now naturally wholly peeled off the smooth surface, and washed away by the rain of 700 years.

The cornicing and friezes, and other ornamental brick work interior and exterior, which were not of colored glazed tile work, had a coat of fine lime smoothing, (without sand) laid on; the coat for the work in the interior, appears to have been nowhere above $\frac{1}{4}$ inch thick but in the exterior, there is evidence in places of a thicker coat, while as regards the ornamental spandril filling of the interior, it will be seen from plates 99 and 100; that over the layer of beaten plaster, itself $\frac{1}{2}$ inch thick, covered with fine smoothing, came a further layer, fully half an inch thick of lime and sand with a surfacing of fine lime smoothing, in which the ornamental scroll work and patterns were cut. The peeling off of portions of this coat, leaving *absolutely no mark, as* will be seen in plates 99 and 100, proves, that this was a distinct and separate coat, laid on after the general coating of plaster to the building had been finished; and *incidentally it proves* that the absence *now* of ornamental work in parts, which *as now seen* look bald, and in painful juxtaposition with highly ornamental work, is no proof, that, where the æsthetic conditions demanded it, such necessary ornament in plaster, (which has wholly peeled off leaving no trace,) did not exist.

The most irrefragable evidence (in the shape of actual remains in sheltered corners) exists, to prove, that the pillars of basalt, in every case, except the polished fluted pillars in the King's platform, had a *thin* coat $\frac{1}{6}$ inch thick of lime smoothing laid on, and possibly colored; this was really necessary, as every pillar in the Masjid, without exception, outside those on the King's platform is a built one, that is to say built of segmental pieces of basalt chiselled to shape, of irregular pieces, and of very varying degrees of fineness; and neither the joints, nor the sizes of the pieces, nor their execution, are so uniform, as to justify the exposure of their naked, unequally smoothed surfaces, and irregular sizes and setting. I believe the fluted polished pillars in the King's Chamber to have also had a very thin (about as thick as

ordinary drawing paper) coat of color, in ornamental patterns, wholly or partially laid on, so as to match the undoubtedly gorgeously colored adjacent prayer niches, but the case of these pillars is so purely exceptional, that here, and here alone, I am able to admit the possibility of the polished monolithic pillar surfaces having been left naked; although as a matter of pure opinion, without any proof, I rather think they were not left naked.

The highly sculptured work in the prayer niches and in the pulpit and elsewhere, have to this day traces of color in sheltered corners, while the cut brick work inside, and the lattice work, still shew remains of the ¼ inch coat of lime smoothing which once covered them.

The interiors of the domes were plastered and colored, and the ornamental bands at the springing, as well as the cut flower work occasionally in the crowns, and the bosses in the spandrils of the arches in the interior, where not of stone, were all of plaster, laid on over the general coat of plaster, then cut to the needful patterns, and carefully smoothed over with a fine lime smoothing.

The tops of parapets, battlements, cornices; all surfaces which rain could beat on vertically, were not only plastered, but had a layer of beaten concrete laid on before the plaster, as also all water channels.

I believe also, that the boundary walls, Muhammadan as well as pre-Muhammadan, were plastered, but as no where is any portion intact left; it is difficult to venture an opinion on its thickness; all that can be said is, that, as the mud-set old Hindu wall, would have crumbled down if unplastered, and as it certainly did not so crumble down, while the Masjid was kept in good order, (since remains of it exist to this day) it must have been protected with plaster.

The old Hindu ghat leading down into tank No. I—(Index plate) had its floors and steps of brick set in mud, protected by beaten concrete, with lime smoothing on the surface. The concrete shewed no traces of lime, it appeared to be simply broken brick, well beaten into a solid compact mass, whose upper surface had a protecting layer of hard lime smoothing, ¼ to ½ inch thick laid on. This I need hardly add is old Hindu work: the use of fine lime smoothing in Hindu work is seen at a very early period, certainly as early as the 1st century A. D., though the of use lime, as a mortar, mixed with sand or surkhi, to bed bricks into, and fill in joints, is not seen (that I can now recall) in any building dating to the pre Muhammadan period.

With the above mentioned materials to build his Masjid, the architect was necessarily constrained to suit his design to the

material. It has been said already, that there is no evidence, of a single stone having been quarried, for the purpose of being used in the *Masjid*. The quantity of stone of sorts, used in the construction, may in round numbers he set down at a lakh cubic feet, while the total quantity of masonry in the building, is, in round numbers, 10·0 lakhs cubic feet; it will be thus seen, that stone forms but a fraction of the total, $\frac{1}{10}$ being stone, and the rest brick, and brick concrete, above floor level.

Add to this, that all the stone is used, in the lower courses, in the pillars, and in the ornamented interior prayer niches, besides what is used as doors, beams, and in the platform of the King's floor; and it will be evident, that practically, the Masjid had to be designed as if for brick, and not for stone as the building material.

The building is however composite in design. As will be shewn further on, the area of the points of support bears a proportion of only a fourteenth to the area roofed over, a proportion far too small for ordinary Indian brick architecture; but to judge from this proportion alone, would be illusory, as the apparent lightness, is obtained, mainly because the building may be said, to be almost built on pillars, which by the way are of stone; but even so, the lightness is obtained at the sacrifice of stability. As will also be shewn further on, the destruction of the Masjid, must be mainly attributed to this lightness of construction.

The pillars, a principal feature in the interior of the building, are designed for stone; they are far too slender for brick; but even so, the architect does not appear to me to have made that allowance, which was necessary for safety, on account of the *mode of construction* of his pillars, (built of stones alternately laid flat and on edge and the core filled in with irregular rubble work.) To the casual visitor, the pillars appear sufficient to do their work, yet gracefully light, and well proportioned; but the engineer, who has seen the mode of construction as disclosed by broken pillars, will not feel surprised, that out of 254 tall, graceful, single shafts, built as above, (not 260 as Franklin says) but 16 now exist intact. I do not include the 18 double (superposed) pillars, in what is known as the King's platform, which are in their upper part monolithic, and in their lower exceedingly massive, and built it appears to me, without the courses being laid alternate, on their beds and on their edges: only the upper half of one of these substantial ones has gone, and that a corner plaster, which as will be seen from plates is thinner than the pillars. When the counter thrust of the arches which abutted against it on the East and North sides was removed by

their destruction, it naturally could not resist the thrust of the arches pushing it from its South and West faces.

Of the other portions, obviously designed for stone, the most prominent and important, as well as graceful object, is the pulpit; the proportions of its parts, are too slender to be suited for brick work, it bears little internal or external stress and strain, has stood fairly well, and but for the falling in of the vault, whose fall destroyed the roof and the handrail, and injured some other parts, it might have stood, a thing of beauty, for an indefinite period. Wanton destruction has however assailed it, no doubt from European hands, for the purpose of carrying off the exquisitely sculptured steps, leading up to the upper platform.

I say from European hands, because none of the poorer Muhammadans or Hindus would have dared to wilfully destroy it, through respect, or fear, or both; for as I have said before, the place is sacred, as a pilgrimage, to Hindus and Muhammadans alike: nor can I regard the Nawabs of Murshidabad (by whose orders the Gaur buildings were dismantled, to furnish stone and brick for their palace in Murshidabad) as having had a hand in its destruction, as the building stands, luckily, too far from water carriage, with no easy roads to facilitate conveyance of the exceedingly heavy stones. If *they* had destroyed it, there is absolutely no reason, why, they should have contented themselves with 2 or 3 stones only, of the pulpit, when they might have carried off the whole, as they did in regard to the light flooring slabs of polished black basalt, from the King's platform. It is the European alone, who, actuated by a desire to present specimens to museums, or carry them off as souvenirs, would remove 2 or 3 only of the stones: it is a shame that those who may be regarded as enlightened, thould commit a barbarous vandalism, surpassing the vandalism of the much abused Bengali, but the thing has been done, and no useful purpose can be served by attempting vainly to shift the burden to other shoulders; while some good may result by exposing the vandalism, practised by men who ought to know better, by the enlistment of public opinion against such acts of wanton barbarism.

The vandalism, greatly to be regretted as it is, has however disclosed one most important fact; it has disclosed the buried great pedestal, of what must have been a life size statue, within the core of the pulpit. The importance of this discovery lies, in the proof it furnishes, of the sanctum of the destroyed Temple, being originally here or hereabouts; as not only does the pedestal fill the core of the pulpit stairs, but the superb canopy of the great statue, and the pillars and pilasters of the doorway leading into the Temple, now form (modified slightly, but un-

mistakeable nevertheless) the main prayer niche, and its surrounding ornamental pillars and lintels. It is not necessary to specify the pieces, any one can identify the pieces, and the original purposes which the pieces subserved, by looking at the Photograph plates.

I have called the structure a pulpit, in deference to current accepted (among Europeans) opinion; but I have already shewn, in a previous report, from the example at Kalna, that the corresponding shrine there, could never have been used as a pulpit; while in support of my newly formed idea, the purpose assigned to these, and similar shrines elsewhere in Bengal, by the people of Bengal, is, not that they served as pulpits, but that they inshrined the effigy of the tomb of the Saint Husain. In short, here rested the symbol, till it was wanted for the Muharram procession; and surely the people, whose ancestors built and worshipped therein, and who themselves occasionally worship therein, may be allowed to know the uses of the various parts, a little better than foreigners, who do not worship therein, and who, whatever they may know of the life of Muhammad, or of Hasan and Husein, are necessarily ignorant of the details, of what, for want of a more appropriate name I must call the liturgy of a religion they never professed.

While on the subject of miscalled objects it may be as well to say also, in regard to what has generally in this Masjid, been called the King's platform, that it is not the King's platform, but a Ladies' platform; not only are corresponding raised platforms, with their separate special entrances, in all the other Masjids in Gaur, admitted to be Ladies' platforms; but, in this particular one, the fact of my having actually found pieces of the fish scale and quatre-foil pattern stone lattice-work, in the debris just under the edges of the platform, goes to prove, even if no other traces of their use existed, (and they do exist) that lattice screens, certainly of the fish scale and quatre-foil patterns, and possibly of other patterns, were used; while the existence of a sloping stone ramp, in the open vestibule to the East of the so called King's chamber, (V. in index plate) seen in section in plates I and 24 proves, that the chamber V. and the platform alluded to, in the Masjid, are not King's chamber and King's platform, but the Zenana portion: for the sloping stone ramp, could not be meant to allow the king to get up to the level of the chamber on horse back, as the horses hoofs would slip on the sloping stone pavement; and no elephant could come in at the door; but the sloping ramp would be needed, and would be just the suitable means, for allowing Palkis and Dulis, to be brought up to the door of the Chamber V. while further corroboration is given

by the close proximity of a covered, and screened privy. (See C. in index plate.) I will accordingly henceforward, designate the raised platform in the Masjid as the Ladies' platform, the chamber V. as the Ladies' chamber, and its attached open vestibule to the East, the Ladies' vestibule; and possibly, though this is only speculation, the portion of original Hindu double wall at P., left unbroken by the Muhammadan architect, was so left to form one boundary, of what may be considered the Ladies' Court.

It must be understood in speaking of the pulpit and the raised platforms, that I confine my remarks to Bengal alone; so called pulpits and raised platforms, occur elsewhere in India, and I have seen them; but in those days, I did not inquire into the uses, of what I thought I knew the uses of already; as I was too conceited to think that a (compared with me, ignorant) native of India, could know more than I had learnt; completely losing sight of the circumstances, that in the first place, my supposed knowledge was picked up from the rather loose writings of European foreigners; and that in the second place, a native, though comparatively ignorant, in almost all other matters, would be immeasurably more likely to know the correct uses of objects used in his own Masjid or Temple, than any foreigner, alien in race, as well as in religion.

The various prayer niches, appear also designed for stone; and well indeed has the architect utilised the Hindu material he found available; see photographs. Although the portions, not found to be suitably ready fitted, among the Hindu monolithic remnants, are built in the usual Muhammadan style, of alternate courses laid flat and on edge; yet, as they really bear but little weight, and are subjected to no internal stresses, they have lasted intact in every case, to this day. The door frames are simply the Hindu door frames, originally designed for, and executed with marvellous patience and skill, in an exceedingly hard basalt, (there are some plainer ones also in granite) and simply utilised where needed, by the Muhammadan architect, after carefully chipping off the figures, over the centre of the top lintel, and the figures supporting the side lintels; but utilised, not inappropriately. The environments of the doors, where used, are in all cases carefully suited to them, as may be seen in plates.

In fact, the architect has designed each doorway, with a special view to the old door frame he was employing; the material he had in hand, has, in the cases of the prayer niches, as well as of the doors, exercised a preponderating influence on the design.

The basement mouldings of the Masjid on its West facade or back wall, appear to me, also, to be specially designed for stone; indeed, I consider that these mouldings, are pre Muhammadan, and that the Muhammadan architect, has simply utilised, the ready made basement mouldings of the temples he destroyed. A comparison of the mouldings in stone marked M. in plates 1, 8, 9, 22 with the corresponding mouldings (in brick however) marked M.′ M.″ in plates 1 and 2, will shew at once, the difference in spirit, between the latter, (which as being in brick are necessarily Muhammadan,) and the former. As the mouldings M. in stone have a maximum projection of 4½ inches, (the brick ones have a projection of 3½ Inches) it is clear, that there could be no constructive difficulty in making the mouldings in brick, similar to those in stone; but the architect appears to have used the one sort, exclusively in the stone built part, and the other in the brick built part.

The special features, apart from the difference in the forms of curves and arrangement of surfaces, to which I wish to invite special attention, are the plain septa marked, S. in the mouldings marked M.in plates 1, 8, 9, 22. These septa, are a peculiarly Buddhist feature, and what is more, are only, exclusively seen, in Buddhist, and in the older examples, of Hindu architecture.

Some great critic of Indian Art and architecture, (I cannot now lay my hands on the exact book chapter and page I would feel thankful to any one with a better memory than I have to give the reference but I rather think it is Fergusson), has propounded a theory, that the septa, are due to the distrust of the earlier architects. The writer goes on to point out, how these septa, originally left solid, came to be hollowed, (bored through behind) so as to carry the retired lines of mouldings through, leaving the surface of the septa unbroken, till finally, practice gave confidence, and the architects dared to cut it through; the modern representatives of these septa, being the little triangular, or other ornamental turned up little excrescences, which occur at intervals, on all later Indian mouldings; the theory is a plausible one, and I could score an easy assent to my statement, that the mouldings in this Adina Masjid, by reason of possessing these septa yet unhollowed through, must belong to a very ancient Hindu building; but I cannot avail myself of this theory as I utterly disagree with it: with all deference to the adverse opinion of the learned critic, I would point out, that men who could build finely balanced Sikharas a hundred feet high would scarcely feel diffident as to the capabilities of stone, to bear shallow cutting into. On the contrary, I maintain, that these septa in the basement mouldings are the remains of the

conventional method of representing the Buddhist railing. Numerous sculptures, have shewn, that the representation of the Buddhist railing, had become conventionalised, and so ingrained by custom, as a time honored ornament, that it was represented on all sorts of occasions; nay, so far had the habit gone, that false railings, not standing free, but *attached* to walls, had come to be represented on topes and on other buildings, which really had no railings round them: in short from a conventional sculptural representation of a real thing, it passed to the stage, of a habitual, conventional ornament; and when the real purpose of the thing had become forgotten, or obsolete, the thing continued to the represented, in forgetfulness of its real origin, in its conventional form, on the basements of the earlier temples, even of non-Buddhist ones. These septa are in short, conventional reminiscences, and direct descendants, of the vertical pillars of the usual Buddhist railing; while the mouldings between them represent the bars. I invite particular attention to pl. LIV. Vol II. Rajendras Orissa, where 3 sculptured relief heads, on the vertical septa, obviously and unmistakeably represent the 3 bosses or sculptured medallions, common to the upright pillars of the real Buddhist railing.

It is therefore that I say, that these mouldings, differ, not merely in the variable forms of curves, and in relief, from the brick mouldings alluded to, but *in spirit*: they essentially belong to an age, just following, or contemporary with, later Buddhism; examples of their occurrence are to be seen on temples, down to the 7th or 8th centuries, so far as I can now recall to mind, and never later, except in Orissa. I have laboriously compared them with the mouldings, from a collection of over a thousand photographs, of buildings in Northern India, in my personal possession, and can only find them in the earlier ones.

Among easily accessible published books I would invite a comparison of these mouldings with plate XI Vol. IX Archeological reports; where, though the moulding is partly buried, the septum is quite distinct, on the right hand basement of the temple, in which the double animal capitals, sufficiently attest its early age.

Specimens of this septum running through the mouldings, in various stages of perfection and on temples of various ages, may be seen also, to quote only a few out of many examples, in Vol. XVII pl. 16, 23 Archeological reports pl. XLIV. Vol. I Archeological Survey Southern India, Raja Rajendra Lala's Orissa Vols. I. II. plates III, IV, V, XXXII and XXXII, XLIV, XLV, LIV, LV and LVI respectively, while for an excellent specimen

of the absolutely unmodified, Buddhist rail ornament, as applied to temple architecture, at the base, in place of mouldings, may be consulted the folio plate in Fergusson's illustrations of Rock-cut Temples, which shews the exterior of the great Kanheri cave. Unfortunately I possess only an incomplete set of the very expensive West of India Archeological reports, and cannot therefore refer to them; the drawings in Fergusson and Burges's Cave Temples are too small to be distinct.

I am aware that in Orissa some of the temples cited in the illustrations, date to the 9th century; but it must not be forgotten; (1), that superb Buddhist Temples, continued to be built there down to a late period; (2) that the later temples standing along side of, or in the courts of older ones, necessarily adopted the ornamental features, more or less, of pre-existing older examples.

In connection with this, my conviction, of the *survival* of *forms, once used with a conscious purpose, even when all consciousness of their purpose and origin have been forgotten,* I cannot do better, that, at the risk of laying myself open to the charge of "padding" my report, quote my learned and honored friend, Raja Rajenda Lall Mittra, in his Orissa Vol. I p. 22: I have felt and may yet occasionally feel myself compelled to differ from him on various points, but I am wholly at one with him, in the following, most pertinent, and carefully thought out opinions.

"To controvert these documentary proofs and arguments, the only fact of any moment that has yet been advanced is that Indian stone architecture in the first and second centuries before Christ shows evident signs of a transition from wood to stone, which could not have been the case had it existed and flourished from many centuries before it. It may at once be conceded that the caves of Behar and of the Western Ghats bear indications of their having been formed after wooden models. The same is, however, not the case with the excavations in Orissa. Were it otherwise, still the fact would not, we contend, necessarily imply that those caves indicate the first stage of transition from wood to stone. It is not to be denied that masonry houses must have followed huts and wooden structures, and the peculiarities of the latter must necessarily, therefore, be traceable in the former; but those peculiarities do not, by themselves, suffice to indicate the exact age, when the transition from wood to stone first took place. There is a spirit of conservatism, a mannerism, or a survival of custom, in architectural ornamentation so strong that it preserves intact forms long after the lapse of the exigencies which first lead to their production. Many peculiarities in European architecture, even of this century, such as the Grecian triglyphs

and mutules, avowedly the counterparts of wooden models, may be ascribed to this cause; and in India such indications may be met with without number both in Hindu and in Muhammadan edifices of the last two centuries. In the fort at Agra may be seen, by the sides of the marble hall of Dewan Khas, two small pavilions of white marble with curvilinear roofs formed entirely after the model of thatched huts.

"They are repeated in the palace of Shah Jehan, at Delhi, and likewise at Futtehpur-Sikri and other Muhammadan cites. Slightly modified they may be seen also on the palace at Bharatpur, and on other Hindu buildings. Until the end of the last century, a common form of temple for Kali in Bengal was a quadrangular, oblong room with two sloping, curvilinear roofs, with gable ends in exact imitation of the commonest kind of hut known in the country. One of the kind still exists in Calcutta, close by the Nabaratna in Sobhabazar, and we have seen several at Chandernagar and elsewhere. Such structures bear the same name, *bangla*, which is given to the huts of which they are counterparts, and in their details, leave out nothing which can be easily imitated in brick, or stucco. Few, however, we fancy, would venture to appeal to them as evidences of a recent transition from wood to brick in Agra, Delhi, or Bengal.

"Mr. Furgusson is startled to find at Bijapur some fifteen centuries after the Christian era, "a recurrence to the same principle. The balconies with their hoods, and the brackets which support these, are the principal ornaments in the four faces of this little monument" (*Mehtari Mahal*). "Yet every part of their construction, every detail of their ornament, is evidently copied from a wooden original. We find the same balconies used at the present day; and in any city between Benares and Boorhanpur similar objects might be found with almost identical details, but always constructed in wood. From the remains of the Hindu temples we know that stone architecture did exist in the Deccan for centuries before Bijapur was founded." To account for this anomaly the learned author continues: "It is clear however, that the Moslims could have had very little experience in building in stone when this work was undertaken, and as little knowledge of their own style as then practised at Agra and Delhi. They must also have been actuated by a wonderful aversion to anything savouring of Hinduism, when they designed a building so original as this, and one so manifestly unlike anything to be found in the country in which they had settled." Bearing in mind however, that the Moslim population of the South was formed of a miscellaneous collection of foreigners, Pathans, Moghals Abyssinians, and others, the bulk proceeding from the North; that

everywhere these men adopted Hindu buildings and temples to serve as mosques; and that the founder of the Bahminy dynasty, Allanddin Hussan, (1347 A. D.,) was a native of Delhi who expelled the Emperor Muhammud Tughlak from Dowlatabad where he had transferred the capital of the Pathan Empire, it is difficult to believe they were so perfectly ignorant of stone architecture as to be under the necessity of copying from wood, and still more difficult to suppose that those who built the largest dome on earth, between 1640 and 1660 A. D. larger even than that of St. Peter at Rome, had, three reigns anteriorly, between 1550 and 1557, so little experience in building in stone, as to copy from wood, and that at a time when the intercourse between the North and the South, was perfectly uninterrupted for considerably our three centuries. We believe survival of custom exerted a much more potent influence in such cases than ignorance. Adverting to the caves of Kennari, at Salsette, Mr. Furgusson observes: "Although the style begins in wood and ends in stone, it is not a little startling to find so little change either in the plan, or general disposition of these caves, during the ten centuries through which we can certainly trace them." And to account for the peculiarity he adds. "The cave at Kennari or the last at Ajunta, is practically identical with that at Karli, in so far as its general plan and design is concerned, and even the last retains so strongly a reminiscence of its wooden origin, that we have little reason to doubt, that the practice of erecting such halls, in that perishable material was continued contemporaneously." This solution of the difficulty, however, is by no means favourable to the position assumed by the author, that architecture in India must have commenced after the invasion of Alexander, (250 B. C.,) because all the earliest specimens show traces of their wooden origin.

"If those traces are visible in stone structures raised twelve centuries afterwards, and may be accounted for by the assumption of imitation from contemporaneous structures, the argument would lose little of its force when applied to the erections and excavations of the time of Asoka, and of his immediate successors. Wooden houses have existed at all times, and exist to this day; but they afford no reason to suppose that races who have known stone houses for a thousand years, in copying wooden features in stone, do so directly from wood, and not from stone which has preserved those features from generation to generation in a country, like India, where custom has exercised the most despotic sway, and held the mind of men in such abject slavery."

The last important feature which is unmistakeably designed for stone is the floor of the Ladies' platform.

Here also as elsewhere, the architect appears to have been bound by the ready-made material available; for, as will be seen from plates XVII and XX, some of the squares between the supporting pillars, are floored by slabs 5″ thick laid across from beam to beam, the beams themselves running squarely, from the double brackets of one set of pillars, to the double brackets of the opposite set of pillars; the slabs in these cases, being obviously, and necessarily long enough, to span the clear space across; while in other squares, the flooring is supported, not by slabs running across from beam to beam, of the principal set of beams, laid squarely across from pillar to pillar; but these principal beams, 12″ × 11″, support a secondary set of beams, 7″ × 5,″ laid diagonally across, and partially cut into them; the space inclosed by these secondary beams, being exactly half that, inclosed between the primary beams; the beams being so cut and fitted into the main beams, that the upper surfaces, of both the primary, and of the secondary beams, are on the same level; it is obvious that by this means, the clear open spaces, to be slabbed across, are reduced very considerably, and smaller slabs could be used, and were so used, as may be seen from the remains yet existing, or fragments with mitred ends, lying about.

But, as in most *early* examples, where Indian Architects have used stone for roofing purposes, the stone used, has been used, more as timber, than as stone; the cutting away of half the breadth of the principal beams, to a depth of $2\frac{1}{2}$ inches, and the further cutting away of half of this cut portion, to a further depth of another $2\frac{1}{2}$ inches, so as to get a secure stepped seat, for the mitred end of the beams laid diagonally across, is a construction, which, one would hardly expect to see in stone; it is essentially a piece of carpentry performed in stone, and must be condemned as faulty in the abstract; but in the particular instances in question, the architect had evidently tested, and found the construction sufficient; for though the principal beams are thus weakened, in their naturally very weakest part, the centre, enough material was left, to safely carry the load of 5″ polished basalt flooring; and though *portions* of the domes have fallen in at some time on these floors, and the floor slabs themselves, have been violently prized away, the beams have, with one solitary, rather doubtful, exception, stood intact, and stand intact to this day, ready to receive and safely sustain, a fresh flooring whenever one may be put on.

It is clear therefore, that granite beams, with a clear span (I take the clear span between the ends of the corbels only for safety) of $6\frac{1}{3}$ feet., and a sectional area of 12″ × 11″ less $5\frac{1}{2} \times 2\frac{1}{2}$ and $2\frac{1}{2} \times 2\frac{1}{2}$ or altogether, an available resisting sectional area of 110

square inches, disposed, (making roughly the necessary allowances for the cuttings,) as a beam 11″ × 10″ have been found, amply capable of bearing a permanent load of 58 cwt. (being that of a quarter square of the flooring, and of the minor set of beams) a moving load of say 4 cwt.; and the incidental shocks of accident and design, for 500 years. Putting these data into the form of the ordinary equation of transverse strength, and assuming the beam to be just able to bear these, with the minimum factor of safety engineers have found necessary to allow, the value of the constant C, is, for this granite, found to be 1·3 cwt.: that is a piece of granite one inch square and a foot long in clear span between its supports, would be just broken by a weight of 1·3 cwt. applied to its centre.

For details of calculation see Appendix II.

The rest of the features constructive as well as ornamental appear obviously designed for brick. The vaulting, the arches, the domes, each heavy, and involving thrusts which had to be provided against and balanced, are obviously necessitated by the absence of stone beams and slabs, long enough to perform the work; but even the ornamental features are designed for brick; it was only a brick cornice which in such a great building would have been confined to a maximum projection of 12″ inches, and it is because the cornice is of brick that the successive small projections (the lowest being a freize projection only 2″ inches but of a depth of from 6 to 8 bricks or 9″ to 12″ inches, so as without breaking to furnish a basis for, and to bear the weight of, the superincumbent mass of projections), have become necessary as constructive expedients rather than as pure ormanent; I invite attention to the three successive freizes which lead up to the cornice, each projecting a little beyond its predecessor; but as three successive superposed deep freizes would have been more singular than tasteful, a correct perception of beauty has interposed minor lines of mouldings and ornamented bands between them, their own surfaces being also ornamented with different patterns, so that without a tedius uniformity, they make up a whole seldom surpassed in elegance, and (remembering the material) in boldness; I also invite special attention to the numerous receding steps between the topmost projection of the cornice and the base of the battlement, also a constructive necessity so as to preserve bond and insure the pressing down of the inner edges of the overhanging bricks of the cornice, but so proportioned and disposed, as to add dignity to the battlements, and to produce an impression of bold massiveness, which the dimensions alone would fail to impart, see plate 22 cornice marked *C* and the corresponding principal cornices which go round the

building in the other plates. The minor cornices confined to particular parts or introduced to reduce the excess of a dead blank wall where such would obviously obtrude, though neither so deep nor so elaborate, are each however designed on the same broad necessities of the construtive material, and the same correct appreciation of true elegance of form and proportion (for details of proportions see Appendix IV).

Comparing in a general way the Adina Masjid built in A. D. 1370 with the Masjid in Jaunpur, of which the Atala dating to Ibrahim Sharki and built in A. D. 1403. (Cunningham XI) resembles it most closely, it will be seen, that one of the principal points of difference is the long line of arches facing the inner courtyard all round, in place of the colonnade. There is little doubt that if beams and architraves in sufficient abundance had been forthcoming, the architect would not have employed arches to support his domes, and heavy piers to resist the final unbalanced thrusts: it is because these were not forthcoming that the more unstable and very much more expensive construction was necessitated by the compulsory use of brick as a building material.

Further in the construction of the great vault, it was mainly the use of brick as building material, that induced the use of the wooden architrave spoken of in page 22 supra; with long stone slabs available, they would themselves have formed the wall plates and obviated the need of wooden wall plates, with the most probable result that the vault would have been now still standing.

That the use of wooden wall plates under the vault, to spring from, was a well known and well recognised and practised method of construction with Indian Architects, is curiously illustrated in such a widely diverse building as the great Temple at Buddha Gaya. There it was found that the great vault over the Mahamandapa on the ground floor, which had long fallen but of which the springing was still intact when I saw it (and dismantled it as late as 1882) was found to have sprung from wall plates of Sal, of which portions were actually found by me undecayed; these wall plates were placed precisely as the ones in the Adina Masjid, and their inner ends were for a short distance let into the flat end-wall of the vaulted room precisely as here, photograph plates 94-98 shews the rectangular socket hole into which the wall plate was inserted in the Adina Masjid quite distinct, I have marked it C; but the wood had wholly decayed, and the cavity was used as a nest by owls, which startled Babu Rajmohan Banerjya, and were equally startled by him, when he made his examination and measurements.

The vault spoken of in Buddha Gaya was clearly Barmese, all authorities are now I believe agreed as to this, and as I am not now writing a report on Buddha Gaya, I content myself by saying that the vault, by the latest research, appears to have been built about A. D. 1080, by the Barmese, in restoration of the vault seen by Hiouen Thsang at an earlier period. This is I understand General Sir Alexander Cunningham's opinion after careful collation of the very extensive mass of facts disclosed during the late repairs, and though yet unpublished, I as his disciple, have had the privilege of learning the most recent views of my venerable and venerated teacher on the subject.

The vault however was by no means a plain sheet vaulting, photographs and plates 6, 94, 98 will prove conclusively that the vault sheeting was strengthened at frequent intervals by projecting arched ribs of the same shape; these arched ribs, (see section plate 6) appear to have projected inwards about 8 inches, (there is not sufficient material available to fix with absolute accuracy the exact number of inches the ribs projected, but whether 6 or 8 inches is immaterial for the purpose now in view, the elucidation of a remarkable feature) the ribs appear to me to have been of stone, not only because a number of large stones which would suit the ribs, were actually found among the debris on the floor of the vault, and must have fallen from the vault, the sheeting of which was wholly of brick, but because in support of this, the only rational explanation of their presence in the debris of the vault, there is the further circumstance, that the marks still existing on portions of the vault, shew beyond the possibility of doult, that the extrados of these ribs extended beyond the intrados of the brick sheet vaulting by as much as 4 inches, as they have in every instance where they occurred left distinct *depressed sharply defined channels* and in no single instance is any single portion of these channels interrupted by projecting *adhering fragments of brick work*, which, had the ribs been of brick, would have unavoidably been left in some one or more portions, even if the existing brickwork of the vault, had not shewn that had the ribs been of brick they would have been carefully bonded into the superposed vault sheeting, and therefore would not, and could not, have left the clear, sharply defined depressed channels which now exist and were for a long time a puzzle to me.

Supposing however, stone arch ribs 12 inches thick had been built at the points to be presently indicated, and the brick arch sheeting, built with its intrados struck with the radius necessary to leave 8 inches of these stone ribs projecting internally: and that in the general ruin of the vault, these stone arch ribs also fell,

as indeed they could not avoid doing when, as will be shewn the abutments gave way, what would be the resulting appearance of the ruin ?

It is clear that the brick sheet vaulting and its backing, built of bricks and good mortar as they undoubtedly were, would remain intact in the lower parts of the vault from the circumstance that (1) the brickwork vault-sheeting and its backing, with their numerous joints filled with mortar, would, with good mortar, form as it were one mass, which, *up to a certain point*, would remain overhanging; the weight of the backing forming as it were one mass with the sheeting, keeping the overhanging portion of the sheeting from over balancing and falling in, (2) the the overhang would, in the case of the brick vault sheeting, which sprang *flush* from the supporting wall, be at any point, very little, *compared with the overhang of the same point of the stone rib*, whose intrados was not *flush* with the supporting wall or pilaster, but began at its very start with an *initial corbelled overhang* of 8 inches.

Consequently as the stone rib was but 12″ thick, of which only 4 inches at the springing rested directly on the supports, the rest, (whether the corbelled projection P. on plate 5 were 8″ or 6″) being really all overhanging from its very starting, and only kept in position by the thrust of the arch against the abutments; it would, as soon as the abutments gave way, fall in, and as the very lowest courses of the stone rib and the corbelled stone from which it sprang, were all really overhanging, and as from the fewness of joints, the impossibility of properly bonding brick work and stone work, and the naturally weak adhesion of brick work to stone work, the force holding the stone by *force of mortar to the brick backing would be small*, (if not immediately yet assuredly in the course of a very short time), every single stone of these stone arch ribs down to the corbelled projection inclusive, would get detached from its backing, and fall in on the debris inside, on the floor of the vaulted chamber.

The result would be, that the appearance presented by the ruins of the vault would be *exactly* what the ruins now actually present.

The importance of the subject must be my apology for such a lengthy disquisition on this one topic; the instances of vaulted sheeting built on arched ribs are so rare, (I can now only call to mind Islam Shah's bridge over the stream separating his detached island fortress of Selimgarh from the mainland) that it appears to me necessary to establish, with the amplest proofs, the occurrence of this rare architectural feature in the Masjid here, built so much earlier than any other known example, in fact; this is the first and ear-

liest instance of the use of arched ribs strengthening vault-sheeting, that I am aware of in India.

The existence of the marks of the ribs in the remains of the vault, is naturally to me, as to every one else absolute proof of ribs having at one time existed.

But to me the presence of large numbers of cut stone in the debris which I removed some years ago from the floor of the great nave, is the most convincing argument of the ribs having been of stone; and it may be useful to some, and will certainly help to relieve the tedium to all, of reading a heavy professional report, for me to relate how it happens, that the actual existence in the debris of the vault, of the squared stones which I removed, is to me the most conclusive proof of the vault ribs having been of stone.

In 1874 I was at Bharhut with General Sir Alexander Cunningham, engaged in excavating the great stupa; naturally the mechanical work of supervising the excavations and taking measurements and photographs fell to me, while General Cunningham did the mental work: One gateway pillar was standing, a fragment, the magar (or alligator) end of the cross beams had been found, see plate IX Bharhut stupa, and there the matter rested for some time, while my attention was devoted rather to the exhuming of the numerous coping pillars, &c., meanwhile however small non-descript battered fragments of no value whatever as sculpture, were being occasionally found and thrown aside, as uninteresting battered and mutilated fragments. At the close of each day, during or after dinner I would report to him the day's progress and finds.

One day my poor little boy (whom I have lost since) carried as a curiosity to General Cunningham, one of the very smallest of the fragments which I had considered of no importance, and with which consequently he was allowed to play; when I saw General Cunningham that evening, he was somewhat more excited than usual, shewed me the small *fragment* of a small sculptured horses head which my son had carried to him, and said it was a very important fragment, were there more such fragments?

Next day I sent to him a heap of, as I thought, perfectly useless fragments which had been found, and as it happened had been found in the vicinity of the gateway pillar. The fragments of Toran beams with the elephants, and the one with the lions were also found in due course and were of course at once recognised by me as well as by General Cunningham; all these pieces he ordered me to photograph to scale which I did.

In a few days to my astonishment, I saw a great sheet of paper on which he had drawn the Toran gateway; not then quite

so complete as it is in plate VI Bharhut (which is a reduced photogaph of the original sheet) but very far towards completion.

It appeared then to me almost as if he had done it by a happy inspiration; but he explained to me step by step every detail of the train of reasoning that guided him, and then I found that it was the accidental presenting of that little fragment, which in my conceit I had considered useless, that had led to the restoration (on paper) of the gateway.

His good humoured but sarcastic remarks to me, as to whether I thought the pieces which were found had rained down from the sky, or whether I thought the architect who built the gateway did not know his business, but had collected all sorts of irrelevant sculpture to play with; thoroughly took all the conceit out of me then, and I hope the greater portion of it permanently; (but vices are hard to kill) and I learnt the full value of his kind advice to me, which, as it is the most valuable advice I ever received regarding my present profession, and as the days of exclusive guilds when bodies of men *combined to keep all professional secrets in their exclusive rings, have or ought to have passed away*, I give in substance.

If you wish to understand and enter into the spirit of any work, do not begin by assuming that because the man who did that work, lived, in what you consider barbarous times, that he did not know his business as well as you do. On the contrary, to succeed in understanding the work, you must begin by assuming, that the man knew his business at least as well as you can possibly do, and probably very much better.

Can it be matter of surprise that this man, who with his high official position, his admitted authority as one of the fathers of Indian Archæology, and what is not so well known, his vast general knowledge, and remarkable conversational powers, was so free from an unworthy desire to keep the secret of his success in research to himself as to give freely to one who had no manner of claim whatever on him, the advice he did; and so void of conceit as habitually to be able to act on it himself, has earned the respect of almost every one who knows him, and from me who have been in constant friendly and respectful intercourse with him for 18 years, not merely respect, but the much deeper feeling of veneration?

Those questions of his, whether I thought they rained from the sky, or whether I thought the architect collected them to play with, always occur to me now when something turns up during exploration which I cannot at once explain or account for. It could be the interest of no one to have brought the squared stones and buried them in the rubbish, where I found them; and they certainly did not rain from the sky.

The last important feature which it is necessary to touch on here, is the screen wall in front of the vault. It is impossible that the great arched opening 48′0″ feet high could have been left wholly open for rain to beat in during 6 months in the year, and render worship there in personal comfort impossible, nor, comparing it with the Atala Masjid, (Cunningham vol. XI pl. 36 can there be any doubt, that a screen wall of some kind, with moderate sized entrances, and one or two tiers of windows closed the great opening and sheltered the worshippers from sun and rain. The projecting stones of the ribs at P. P. see plate 6 and photograph plate 98 limit the thickness of the screen wall to 28 inches, and there is no option but to accept this 28 inches as the thickness of the wall; it is not sufficient, remembering that the wall was 48 feet high and that it rested merely on the floor of the vault, for permanent stability; but since, as long as the ribs P. P. pl. VI stood, the upper part of the wall from a height of 27 feet above the floor, right to the top, was safely nipped between these ribs, and not liable to be moved; the wall would be safe so long as these ribs remained intact; when however the giving way of the abutments caused the destruction of these ribs (and of the vault) this thin wall 28 inches thick and 48 feet high, obviously not bonded into the side walls, (as may be seen from the photograph plate 98 where the entire South surface of the North abutment, of which a vertical strip 28 inches in width, must have been covered by the screen wall, is seen to be perfectly smooth and therefore never bonded with the screen wall), and as before said, only resting on the stone paved floor of the nave, would he very shaky, and would be liable to destruction, not by gradual disintegration, but by falling down flat *enbloc*. And this is what appears to have actually happened, for no trace whatever of the wall exists or was found.

Had the wall been of stone, the stones would have been lying where the wall fell, in fairly close order to be unmistakeable, and possibly even capable of furnishing with moderate accuracy the sizes and number of the openings (windows and doorways) in it, but such was not the case, the wall was therefore I conclude of brick, which of course when it fell broke into too many pieces, and were too confused with the debris of the spandril of the great arch and of the battlements and upper parts of the abutments, to retain any identity of itself, or to furnish any useful information regarding the sizes of the openings.

It will have been seen that the architect, careless though he was to an extent which modern Indian P. W. Architects would not be guilty of, had so far designed the building not only with great success in an æsthetic point of view, but had kept clearly

in view the materials available to hand, so as to utilise them to the utmost ; and but for a very serious error of calculation to be noticed further on, had shewn himself a good Engineer as well as an able architect: no less clearly has he displayed his foresight and capacity in providing for the efficient drainage of the great building he was erecting.

It will be seen, on comparing plate 3 with any of the Sections of the West main vault or cloisters, that the pillars in plate 3 of the East cloisters are much taller and the springing of the domes, as well as the positions of the cornices, much higher with regard to the floor, than in the West cloisters ; even the ornamental shallow niches on the outer or East facade of the East cloisters plate 2 are much taller (and consequently *appear* narrower) than the corresponding ones on the West or back facade of the West cloisters. This is due to the circumstance of the floor of the East cloisters at its lowest point, being as much as 5′ 0″ feet lower than the floor of the great nave of the Central vault, which is, (except the floor of the Ladies' Chamber) the highest point in the floor of the Masjid.

A careful examination of the various detail sections will shew that the heights of the pillars and niches, and the springings of the arches over the pillars, and of the domes they carry, vary considerably. All these variations, (except the variations in the springing and heights of the arches which immediately face the inner Courtyard on the 4 sides and which will be separately noticed) are due to the circumstance that the entire floor slopes gently, from the nave as its highest point to the portion of the East cloisters at the Gargoyle, as its lowest ; the floor has a double slope, (1) the slope already noticed running from the nave along the North half-length of the West, the entire of the North, and part of the East cloisters on the one side, and along the South half of the West, the entire of the South, and part of the East cloisters on the other ; to the point opposite the Gargoyle as the lowest point, and (2) a transverse slope from the prayer niches on the West, and the various lattices on the North, South and East cloisters, inwards towards the Courtyard. This transverse slope amounts in the case of the great nave to 9½″, in the West cloisters to 9″ and in proportion in the narrower N. S. and E. cloisters ; to avoid complication this transverse slope has not been shewn in the drawings.

It is clear that all water, rain or other, which found its way into the cloisters would be at once discharged into the inner Courtyard all round.

But along the foot of the line of arches all round the inner Courtyard, ran at one time, a shallow (6 inches deep) catch water pakka terraced drain, the dimensions of this drain being, a bottom

width of about 2 feet, with very flat sloping sides; the whole of beaten concrete terracing; the entire width of the drain (I estimate for no part was found quite intact) at the top being about 5 feet.

Into this drain would necessarily drain not only all stray water from the cloisters and all the water from the Courtyard, which was so levelled as to lead into it, but also the water from half the roofing of the Masjid and cloisters; the roof in the case of the West cloisters having a fall of no less than 3′ 5″ transversely from the centre, obtained by the coat of concrete in the spaces between the domes, at the centre, being thicker than at the edges: the roofs of the other cloisters sloping in similar proportion.

This drain, following the slope of the floor of the Courtyard, had its final outlet into a covered, stone lined, underground channel, which passing under, and across the East cloisters, discharged the accumulated waters, from the Gargoyle shewn in plate 3, into a brick stepped channel; which by means of a succession of slopes and falls, eventually delivered the waters into the tank marked 3 in the index plate.

The slope given to the drain (and to the floor) within the inner Courtyard, was accordingly measuring the length along the line of flow, 7·0 Inches per 100 feet, a slope far more than was needed, but assuredly it possessed the advantage of discharging with corresponding rapidity and efficiency. Its destruction I ascribe, not to its excessive slope, but to there being no protecting slabs of hard stone inserted at intervals to receive the shock of the water flowing down from the roofs.

The excavations undertaken some years ago did not disclose whether the Courtyard was wholly terraced throughout; it assuredly was not paved with stone slabs, but I infer from the circumstance that large tree jangal was not growing in the court, but rather a bushy thorny scrub (infinitely more troublesome to cut, and more destructive to the clothing of adventurous explorers) that the court was once terraced pakka; as it is a commonly known fact, that tree jangal does not take kindly to ground beaten down hard and covered pakka with beaten concrete over a layer of brick.

It has been said that the level of the outer Courtyard at the East is now 5½′ feet lower than the level of the Courtyard on the West side, (judging from the exhumed terracing over the ghat in Tank I of the Index plate.

From the levels of the various plinths along the outside of the building, the outer plinth does not appear to have been sloped longitudinally; it would necessarily have to be stepped somewhere. That it was so stepped, was shewn in the buried lower footings of

the East wall of the East cloisters, but the North and South plinths were not in sufficiently good order to enable the stepping to be ascertained, though there can be no doubt that it was stepped at intervals to keep in some sort of harmony with the fall in the ground level. The total difference between the level of the plinth on the West face which is the highest, and the lowest on the East face, being 3′ (that of the ground level being already said 5½′). I do not remember, (nor does Babu Rajmohan) its being stepped on the West face.

The nature of the soil is unfavourable to drainage. A red ferruginous clay which appears to have the property of obstinately retaining water (as I have had very good reason to know to my cost, during the excavations to ascertain the footings in the East wall and in digging the new well in the inner Courtyard) appears to have been, and probably was one reason, why the architect considered it necessary to give the great slope that he did, so as to obviate as far as possible, the soaking of the moisture into this intractable bed ; below this, a yellow clay with nodules of kankar gradually increasing in size and frequency, terminates at last in a hard deposit of solid block-kankar, at a depth of 25 feet below the court : into this hard kankar the digging was carried for a few feet to obtain fairly good water, the kankar continuing solid, but, as usual with kankars, with numerous cavities throughout.

The total area roofed over, including the area of points of support amounts to 85,000 superficial feet, supported at the floor level on 12,500 superficial feet of walls and pillars, giving an average of 6·8 to 1, or say in round numbers 1 to 7 as the proportion of the area at the floor level of the points of support to the area roofed over ; but of this the pillars aggregating 2,000 superficial feet, support 45,000 superficial feet, leaving only 4,000 superficial fete of area roofed over, as directly supported by the walls and piers, which gives for the portion supported by the pillars a proportion of 1 to 22 5 at the floor level at their bases, and of 1 to 75 only for the shafts ; and for the walls of 1 to 4, remembering that in both cases the area of the points of support is included in the area roofed over.

Including the open courtyard inside, we shall have an average of 1 to 14 as the proportion of the area of the points of support to the total area of the Masjid within its four outer facades.

The total volume of air-space inclosed amounts to 1,800,000 cubic feet, and the total volume of masonry employed in effecting this amounts to 80,000 cubic feet, giving a proportion of 2·5 cubic feet of air-space per cubic feet of masonry exclusive of foundations and floor. Including foundations and floor, and *assuming* that the foundations are not less than 6 feet

in depth (the excavations were carried down 5 feet in depth in two places without coming to the beginning of the foundations) there would be in this building, a total expenditure of 9,80,000 cubic feet of masonry for inclosing 18,00,000 cubic feet of air space, and for roofing 85,000 superficial feet shelter, or in other words each, cubic feet of masonry helps to roof only ·087 superficial feet of surface, and to inclose 1·84 cubic feet of air space. It must be noted that the above calculations, of area roofed over, includes the area of walling also. Excluding this, the averages shew, that in this building each cubic foot of masonry (including the floor estimated at a foot thick and the foundations) roofs over ·075 superficial feet of available clear area, and incloses 1·84 cubic foot of air space.

The intensily of pressure at the floor level will be found to be; assuming 115 lbs. for the weight per cubic foot of the mixed stone and brick work; on an average, $3\frac{1}{3}$ tons per square foot; this however is an illusory average, as the pressure is very unequally distributed, there being a total pressure of 39,000 tons on 10,300 superficial feet of walling and of 3,300 tons on 2,000 superficial feet of pillars or an average for walls of 3·8 tons per square foot, and for pillars of 1·65 tons per square foot at their bases. But this rises to $4\frac{2}{3}$ tons per superficial feet for their shafts at the springing of the arches.

The intensity of pressure on the foundations, is found to be 3·45 tons per square foot of walling; but for the pillars, as I have reason to believe that they are built on the floor without any special long lines of walls for foundations as would now be invariably done, the intensity of pressure would continue to be 1·65 tons per square foot.

In the Public Works Department, Bengal, the intensity of pressure which is regarded as safe (for Calcutta) is $1\frac{1}{2}$ tons per square foot.

In the pillars the maximum intensity of pressure, on any point occurs, not as may be supposed at the foot of the shaft of the tallest pillar of the East cloisters, where it is only 3·6 tons per square foot, but at the necks of the capitals whence the arches spring, where it is $4\frac{2}{3}$ tons per superficial foot.

On the piers and abutments of the vault, the direct downward pressure on the piers amounts to $12\frac{1}{2}$ tons per square foot, an amount no longer within the margin of safe pressure; on the abutments it is 4·9 tons per superficial foot; for details of pressure on various parts, see Appendix III.

As regards other forces in the building, the only one that is of any practical importance is the question of thrusts, here however at the outset, it is obvious that they may be divided into two

broad classes, the thrusts of the arches in the building varying in span to a maximum of 11½ feet, and the thrusts of the great central vault and its front arch.

In regard to the former it is obvious that they may be subdivided into two classes, arches which spring from piers, and those which spring from pillars.

The piers are so massive, that it would be pedantry to proceed to calculate the thrusts, which cannot by any possibility even approach the limits of stability of the piers, as will be obvious to any professional engineer; nor, but for precisely a converse reason, is it necessary to calculate the possible thrusts of the arches with their heavy load of domes 2 feet thick which spring from pillars of only 10 inches radius at the neck, which it is equally obvious cannot be expected to resist the thrust. I am aware there is among non-professionals (non-engineers) a vague notion that every arch springing from horizontal skewbacks (that is the bed of whose lowest voissoir is horizonal) has no thrust; this report does not profess to be a treatise on applied mechanics and I would refer them to Moseley's Chapters on the theory of the arch, to Rankine, Wiesbach, and others, for a refutation of this fallacy In the second class, the great arch of the vault is (see plates 5,6 almost identically the same as the arch of the vault, and the only material variation is the load thereon; practically therefore if the conditions of stability of the vault are determined, all that is really necessary will have been done.

In doing this however there is a serious difficulty owing to the circumstance that the vault does not exist, and although there is no doubt as to its form, there is nothing to shew how it was loaded at the crown; for that it had a load of some kind on its crown, appears absolutely certain from every other example that I have yet seen (without exception).

To get round this difficulty which cannot be surmounted it has appeared desirable to investigate the conditions of its stability within practically limiting conditions of the load, and the details will be found in Appendix III.

By shifting the position of T and Q Pl,88. it is obvious that the intensities and directions of the limiting pressures may be found for any number of points, and the curve of pressures drawn, but it is also clear from the form of the final equation, and the direction of the final thrust with the minimum of load, that the curve of pressures can never cut the *intrados* between the points T and C so long as the load on the crown is above that minimum; and similarly that so long as the pressure does not exceed the maximum of the calculation, the curve of pressures cannot cut the extrados of the vault, assuming the extrados to be of the form drawn; that is the arch together with its solid backing.

As the backing with good mortar forms practically one solid mass with the arch sheet proper, this last assumption though wrong in theory, is *under the actual conditions*, not unwarrantable.

But as the *direction* of the final thrust cuts the arch intrados below the point T. (see plate 88 diagram of forces), it is clear that for the stability of the arch, considered in itself, that is with absolutely immoveable abutments, the load on the crown must be greater than the minimum calculated as necessary to insure the portion TC not turning down round round T.

It is also obvious from the equation of the final thurst, that in order to save the intrados below T from being cut by the line of pressure by increasing the load on the crown, the *intensity* of the thrust will be very materially increased.

But already the equation of moments shews that even with the minimum of pressure the moment of forces tending to overturn the piers closely approaches the moment of forces tending to keep the piers from overturning.

Therefore it is clear that the loading needful to prevent the line of pressures from cutting the intrados below T, and thus causing destruction to the arch, not by the overturning of its piers, but by the revolution of portions of the arch round the points of rupture, will land us in the no less serious difficulty of causing the destruction of the arch by the overturning of its piers.

It will be noticed also that there has not been allowed, nor is there room, even with the minimum of pressures, for any "factor of safety."

The overturning of the piers, would however not take place, notwithstanding that the moment of overturning exceeded the moment of stability, so long, and only so long, as the counter pressure of the heavily loaded arches of the adjacent aisles acted on the pier to help in preserving it from being overthrown.

It is therefore evident that the architect did load his arch sufficiently (by some rule of thumb process for it is clear he never could have actually calculated the forces and yet have deliberately left his piers so weak) to save it from destruction by the turning round of its pieces round the points of rupture, and the piers sustainod the final thrust, solely in virtue, not of their own stability, but of the counter thrust of the arches of the adjacent aisles.

Of course such a state of things could not last. Not only was the direct crushing weight on the piers far in excess of what a due regard to the factor of safety would have permitted,

but the centre of this pressure, was, by reason of the thrust, thrown further outwards than the centre of gravity of the pier base, still more increasing the intensity of direct crushing force on the outer courses, while somewhat relieving the inner courses. Add to this the fact of the piers being of themselves incompetent to sustain the horizontal portion of the thrust with its powerful leverage. (And only standing because of some counter thrust), and that the architect wound up the entire construction by springing his great arch from perishable wooden wall plates; and a combination of conditions is at once disclosed, which could not but *insure* the destruction of the vault.

No doubt the process of sinkage of the outer edge of the piers under the enormous pressure thrown on them, went on slowly for a number of years, while during that period, the gradual decay of the wall plates also steadily proceeded, until perhaps an earthquake which would have been of no consequence had these dangerous conditions not existed, completed the collapse of one set of piers, or the leakage of water from cracks (inevitably caused by the slow sinkage of the pier-foundations on the one hand, and of the arch springing at its intrados), lessened the already overstrained powers of resistance of the piers to direct crushing, and they partly crushed, and partly got pushed out of plumb, permitting the fall of the vault; the marvel being, not that the vault fell finally, but that it contrived to stand for a number of years.

With the fall of the vault and of one set of piers (the South piers) would naturally fall the adjacent arches and domes of the adjacent 2 or 3 aisles. and as this would leave the next row of arches and domes, borne only on the slender pillars, they would also fall, and this process would go on in aisle after aisle, not only till it reached the South end-wall of the Western range, but it would, on reaching the line of the South range of cloisters, involve them also in the same steady destruction. And when all the arches and domes of the South cloisters fell, the fall of their last domes and arches, would involve the destruction of the arches and domes of the South end of the East cloisters, every single arch and dome of which would fall in succession till it passed the destruction on to the North range of cloisters, and from this North range of cloisters, the destruction would extend to the North half of the West range, until finally it would reach the North piers which the fall of the great vault by the collapse of its South piers, relieved from the action of forces it was incapable of bearing with safety. This is what ought to happen.

What has happened is precisely this, only the destruction has not yet extended to the North piers of the great vault. See the

index plate, as also Cunningham and Ravenshaw. Every single dome is gone except those between the North pier and the North (outer) end of the Ladies' platform; and these are also going one by one.

As the vault stood intact for a number of yeare, there was time for the mortar to harden, so that by the time it fell, the arches and domes resting on the pillars, were really solid masses which might be regarded as sculptured and hollowed out of a vast mountain of concrete, and they would not fall at once, nor, even if roots of trees cracked the masonry of any but the free standing end row of domes or piers; but when the root of a tree did crack an *end* dome or arch or pier, so as to remove the one condition of its safety, *viz.*, all its parts being so cemented together as to be one continuous solid piece, that dome would fall, and the next would await its turn.

In a report submitted to the Bengal Government in 1885, occurs the following passages.

"When seen by Ravenshaw, the only portion of the building which had roofs still existing, was a portion of the North cloisters, where 45 domes then stood intact: at present only 38 exist, and of these several are tottering and partially fallen; six domes have consequently quite fallen between the years 1867 and 1383, when I first saw the building, and one has fallen between 1883 and 1885."

"Ravenshaw's volume does not shew the state of the building sufficiently in detail, to enable a comparison to be drawn between its state then and now; but judging both from his and from General Cunningham's plan drawn in 1879, I gather that three of the arches on the South of the great main vault, and four of the arches of the South corrider then standing, have since fallen, as well as five arches of the North and South cloisters and three arches near the South-East corner, making a total of fifteen arches in the sixteen years between Ravenshaw's visit and my first visit, or nearly one arch a year. I have been myself obliged to pull down one arch which had become dangerous, to prevent its spontaneous collapse at some moment on my work people."

My experience has now extended another three years, and I find that since 1867, the year of Ravenshaw's visit, there has fallen altogether 20 arches and 9 domes in the 21 years. Supposing that the first 3 rows of arches and domes in the 3 aisles nearest the vault fell along with it, there would be a balance of 300 domes and 620 arches (in round numbers) fallen at some time from date of the fall of the vault to the current year. The rate of destruction must therefore have been much more rapid in previous years than it is now; probably the tall pillars of the East cloisters fell with

their domes and arches, much more rapidly. Any way, as Pandua continued the capital down to the reign in 1392 of Jalaluddin who removed it to Gaur, it may be conjectured, that till then at least, the vault had not fallen; possibly the destruction of the great Masjid, was one, among other reasons, for the removal of the capital to Gaur.

If such were the case, the Adina Masjid built in A. D. 1369 stood intact for the brief period of 23 years, or say in round numbers 25 years: but even this period is more than a consideration of the combination of destructive agencies working against the unfortunate vault would warrant.

The arcs of the vault are described from centres on the springing line, and radius equal to $\frac{2}{3}$ span, in other words the span being divided into 3 parts the 2 points of division are the centres from which the arcs were struck.

All the open arch ways in the Masjid with the exception of the arch ways opening into the Courtyard are drawn on this; system, the radius being $\frac{2}{3}$ of the clear span at the springing, but it must be remembered that in every case except the vault the arches start at their springing with an initial over hang of a few inches; this of course helped to throw the point of action of the final resultant pressure inwards, that is more centrally over the pillars than would have been the case otherwise.

But with a careful consideration, for which the defective calculation of the forces acting in the vault would have little prepared us, the architect has varied the shapes of his arches to suit the greater or lesser forces acting on them, thus the arches over the lattices, which are not left open, but closed, and therefore, subjected to a lesser strain, have their curves struck with radii equal to $\frac{3}{5}$ span. thus making the curves of larger amplitude, and the crown lower; while the arches opening into the Courtyard which are all open and bear the weights of the battlements, and heavy cornices, in addition to their share of the load of roofing, are struck with radii equal to $\frac{5}{7}$ the span, thus giving curves of lesser amplitude and raising the crown higher than the $\frac{2}{3}$ span radius would have done; lastly the two arches on the two sides of the great central arch of the nave, which have to bear the heaviest load of all, see plate 6, are struck with radii equal to, $\frac{7}{9}$ the span.

There are lastly the trefoil arches, these bear no heavy weight and are purely ornamental, they may be divided into 2 broad classes, the Muhammadan, to be seen in every trefoiled prayer niche except two, and also in the niches outside, on the outer faces of the Masjid walls; and the Hindu, of which there are but two examples, *viz.*, the main prayer niche, and the niche shewn in plate 23 and marked N in the index plate. They differ

some-what but not much: designating by $s$ the clear span between the capitals of the pillars from which they spring, the centres from which the lower curves are struck, are in each case, $\frac{4}{5}s$ apart from each other and $\frac{1}{8}s$ above the springing line, and the radius with which they are struck is $\frac{1}{5}s$; the points of the cusps are $\frac{7}{8}s$ apart from each other, and as nearly as possible $\frac{1}{3}s$ above the springing line; but in the main prayer niche the upper member of the trefoil is almost a semicircle with a little turned up nose at the crown, struck from a centre at a height of $\frac{1}{3}$ of the distance between the cusps, (that is $\frac{1}{3}$ of $\frac{7}{8}s$) from the springing line, and a radius equal to half the distance between the cusps; in the smaller trefoil however, there are three centres, the two for the lower parts at a height of $\frac{1}{3}$ of the distance between the points of the cusps above the springing, as in the other case, but the curve being a compound one, the lower parts are struck with radius $\frac{3}{5}s$ each, and the upper curve struck in continuation of the lower curves, from a centre on the same line, and midway between the centres of the lower curves of the trefoil, that is at a height of $\frac{1}{8}s$ above the springing as in the other; this curve is also broken at its crown and turned upwards into a little peak, to mark the crown.

The Muhammadan trefoil of the prayer niches are much simpler and not so graceful; its three curves are all struck with a radius equal to $\frac{2}{7}$ of the clear span, the two lower centres being on the springing line; here as in the Hindu trefoils, the curve of the upper trefoil is broken and turned up-wards to mark the crown.

In the outer niches, the same rules hold in some, with the exception that the crown is not turned upward, see plate 8, upper niche; but in others, the two lower niches are struck as just described, but the upper member is described from 2 centres on each side of the central chain at a height of $\frac{1}{3}$ the span from the springing line, with radii equal to $\frac{1}{6}$ the span.

There are cinque-foil cusped arches and arches with larger numbers of cusps; in most of them the curves are all struck with the same radius, but they are not of sufficient prominence to need a more detailed notice.

The proportions holding in the Hindu trefoil arches (the only kind of Hindu arching of which specimens exist in the Adina Masjid) is thus seen to be materially and radically different from the proportions used in the Muhammadan trefoil arches; no less pronounced is the difference between the proportions of Hindu rectangular openings and the Muhammadan.

There are 4 Hindu door frames in good order in the Adina Masjid, the two posterns marked D and Z and the two doorways in the Ladies' Chamber marked H and K (see index plate, and

plates 15, 19, 21, 22). In each one of these, it will be found that the height is very nearly twice the breadth of the openings. Of Muhammadan square openings, there are none quite open, being either niches as in plates 11, 7, 18, 23 or filled in with lattice work; see plates 2,3,22, but it will be found that the square frames of these lattices measure in height just $1\frac{1}{2}$ times the breadth in some, and even less, see plate 1. Whether the inside, the middle or the outside of the various rectangular framings be taken, the proportions do not, except in two cases, come up to twice the breadth for the height; one class of niches where the proportion is twice, is to be found in the upper row of rectangular niches on the South (and North) and East facades, where the rectangular space within the highly ornamented outer framing, is in height twice its breadth, see plates 1 and 2. In the lower arch-ways of the so called pulpit if we take the rectangular frame work within which the arches are set, see plates 13, 14, the proportion is also 2 to 1.

In the arched openings; as the floor slopes, while the springing line of the arches is retained at the same level, there cannot be expected any definite proportion, but in the side archways of the vault, see plate 6, and in the archway of the side prayer niche, the height of the square portion below, is just about equal to the span, while in the small prayer niches along the aisles, the height from the lower mouldings to the springing of the trefoils, is $1\frac{1}{2}$ times the span between the supporting pillars.

The proportions holding in the pillars that support the arch-ways, which are all Muhammadan varies naturally with the heights of the pillars, which necessarily vary as the floor on which they rest slopes, while their capitals are all placed at the same level. None of the 4 pillars, of the Ladies' Chamber have been found, nor even are the pilasters there intact to furnish the proportions, but in the lower massive pillars which support the Ladies' platform, the proportions are (taking the pillars as round, they are polygonal) the shaft equal to only 3 semidiameters and the entire pillar (base capital and corbelled sur-capital together) equal to $4\frac{1}{8}$ semidiameters nearly, while in the round shafts supporting the arches, the shafts vary from 8 semidiameters to 11 as a maximum; and the entire pillars from 10 to 15 semidiameters from floor to springing of arches over their capitals.

In the fluted pillars of the Ladies' platform, the shafts are only 4 semidiameters, and the entire pillars nearly 6 semidiameters These are all the Muhammadan pillars, the others are all Hindu, and the proportions are much more graceful; most of them being 15 semidiameters altogether, with their shafts alone 11 semidiameters high, while some are more gracefully slender, being in the case of the thinnest, $15\frac{1}{2}$ semidia-

meters high altogether. But the shafts of these Hindu pillars are all of single stones, monoliths, and notwithstanding their slender proportions are a great deal stronger than the built muhammadan pillars, built too in the slipshod style mentioned in page 24 supra.

The external corner towers which possess in some sort the characteristics of pillars, the proportions are for the Kumbha base or attached mouldings of shaft, 1½ semidiameters nearly; for the shaft up to the first band 2 semidiameters, the band itself being 1 semidiameter in height, then shafting again 3 semidiameters in height, which brings the total height of what may be considered the whole shaft up to the capital to 7½ semidiameters; surmounted by the main cornice (which may be taken to represent the capital) 2 semidiameters in height (as stated in page 39 sup, the recedings steps above the cornice I regard as belonging to the battlement.) The total height of the tower (from the top of the mouldings common to it and to the walls) including attached Kumbha base, capital, and upper neck, between the capital and the dome, being 12 semidiameters and the conjectural height to the summit of the pinnacle, 14 semidiameters; the basement moulding, which may be taken in place of the bases of pillars, being in addition just 1½ semidiameters, see plate I.

For details of the proportions holding in the various kinds of pillars used in this Masjid, see Appendix IV.

I have called the trefoil arches in the main prayer niche and in niche N. Hindu; apart from the marked difference between the construction and proportions of these niches and those in brick work, and which for that reason alone are undeniably Muhammadan, I would invite a comparison between the trefoils in plates 11 and 23 and in 108, the latter of which can have no possible suspicion of being even remotely influenced by Muhammadan architecture or ideas; and the result of the comparison must prove conclusively, that the trefoils in plates 11, 23 and 108 belong to the same age. It is worthy of note that the blue stone work in the Temple at Buddha Gaya, of a stupa sculptured in which, the plate 108 is a photograph, dates to the reign, so far as we now know, of Purnna Varmma, contemporary of the great Aditya Sena Deva, the Adisur of Bengal, to whom I have on wholly independent grounds, ascribed the construction of the Temple (see p. 11, 12 sup) of which the site is occupied by, and the materials utilised in the Adina Masjid.

The spandrils of the arches, and more especially those whether openings or closed niches, which are set in rectangular panels, are in many cases ornamented with bosses; my impression, judging from remains of some plaster bosses (see plate 99) is that every arch without exception, had these bosses, whether cut in stone, or

moulded or cut in brick or in plaster; the two former have remained while the majority which was only in plaster, have fallen off leaving no trace, for these and similar ornaments cut in plaster, have in many cases (see page 27 ante) fallen off and left no traces.

Be this as it may, those that exist are of various sizes and variously ornamented; plain, moderately carved or most elaborately sculptured; the very finest are certainly the pair in cut basalt with the fir cone projecting boldly from the centre of one (the other fir cone has fallen off) on the West wall of the nave; they are not properly bosses on the spandrils of any arch; but from examples elsewhere, I have reason to affirm, that they are the counterparts of those on the spandrils of the front entrance archway; occupying on the West wall the position which the bosses in the front screen-wall (which as before said see page 45 ante has long ago fallen) must have occupied on the spandrils of the central entrance.

Incidentally, supposing my conjecture correct, some slight clue is furnished of the span and height of the arch: for as will be shewn below, the boss, if it followed the law which appears, to have regulated the positions of the other bosses in the Masjid, was inserted at a depth below the top of the panel inclosing the arch, of $\frac{1}{3}$ its distance or height from the springing of the arch.

And as the top of the panel was in all probability at the springing of the great arch or vault, which would the most appropriate place for such a marked horizontal line across the front, and as the centre of the boss is 48" below the springing of the vault, the springing of the inner small arch within the panel would be at 144 inches below the springing of the vault; that is 187 inches, or $15\frac{1}{2}$ feet above the floor of the nave and if, as is probable, the thickness of the arch at the crown was 24 inches (it could scarcely be very materially more or less), and if, as is also natural and probable, the extrados of the crown touched the line of the panel at top, the crown of the intrados would be at 307 inches above the floor of the nave.

But as the arches are described in the vast majority of cases, and in the vault itself, with radii equal to $\frac{2}{3}$ the span, a very simple calculation shews, that the breadth of the opening would be 186 inches or $15\frac{1}{2}$ feet; the height of the rectangular portion of the opening has already been determined to have been $15\frac{1}{2}$ feet, and these numbers, are, not only in themselves probable, but the proportion of breadtn to height being precisely that, which, as stated above, page 56 holds in regard to all other openings leading to or from the vault, the probability is rendered all the greater, that in thus calculating out the dimensions of this opening, the correct laws have been used, and a fairly correct result obtained.

As the distances between the centres of the bosses is 296 inches, the breadth across, of the panel, within which the entrance arch was pierced, must have been 380 inches according to the law regulating the proportions to be presently noticed; drawing these various lines, the outline or rather the skeleton of the panel and entrance arch; the result is seen in plate 24 section on line SSS, where CTZ shews the outline of the half arch, and IJY the outline of the half panel.

If after what has been said above further confirmation were necessary, that in the calculations just made, the correct laws have been used, such confirmation would be furnished by the dotted outline CTZ of the arch, which is seen to be just such as to display to the full, and no more, the whole of the superbly ornamented front main prayer niche. What the forms or numbers of the openings were, which filled the lancet shaped space on the front screen-wall above the line of panel IJ, there appears to be no means of calculating with even approximate probability, all that can with any certainly be said, judging from the Atala Masjid so often alluded to, is, that this space was assuredly not left a dead blank wall.

The bosses on the spandrils of the trefoil of the central or main prayer niche, are also fine, and must once have been adorned at their centres by some precious stone, which has since been extracted, and it appears the dispoilers whoever they were, broke the North boss partially, to extract the stone; it is not now possible I fear to determine what the stones were, but I am inclined to believe that they were turquoiuses.

The law which appears to regulate the position of the bosses appears to be, that the distance apart between their centres, is a definite proportion of the *breadth* of the panel, within which is cut the arch, on whose spandrils the bosses are; this proportion is found to be from the average of the details of 19 examples, in Appendix IV to be 0·78, but as it is not probable that such a complicated proportion as 0·78 was really used, the nearest simple proportion $\frac{3}{4}$ is what I consider to have been really what the architect meant to use. I therefore set this down as the horizontal proportion, for the position of the bosses, between their distance apart, and the width of the panel wherein they are placed.

Similarly from the table in Appendix IV regarding distances of the boss below the top of the panel, to which the vertical position of the bosses appear to be proportioned, it is seen that the average proportion is 0·31 of the distance from the springing to the top of the panelled recess, and as such a very complex proportion is not likely to have been used, I consider that the real proportion intended by the architect was 0·33 or $\frac{1}{3}d$.

It is worthy of note that as regards both the horizontal and vertical determinants, the proportions $\frac{3}{4}$ and $\frac{1}{3}$ have actually been used oftener than any more complex ones, while most of the deviations are easily to be accounted for by the inevitable errors of execution and measurement; and though there are some few deviations, see tables, which can scarcely be considered as anything but intentional, these are very few, and the proportions of $\frac{3}{4}$ and $\frac{1}{3}$ differ so slightly (one fiftieth only) from the calculated averages, that there is every justification for regarding these are the proportions legitimately deducible from the Adina Masjid.

I have been unable to arrive at any definite law regarding the sizes of the bosses: some other building may furnish the law or some one into whose hands these notes may fall, may by a happy inspiration discover what I have vainly tortured my brains to determine.

One of the other features, and for beauty not the least important are the bands and cornices; these are also subject to definite laws, and so far as can now be seen are dependant on their heights either above the floor, the plinth, or some main line of battlemented cornice or roof, which cuts off as it were for the purposes of the calculation of the depth of cornice, the portion below such marked general line, and starts the calculation afresh from the new starting point. Some such rule for not indefinitely increasing the depth of the cornice was not only clearly necessary on constructive grounds, æsthetically it was even more necessary not to ignore by overpowering with a large and more important cornice, those main general lines, which it was the object of the architect to draw attention to as marking important constructive features; at the same time, the minor bands, put in as it were to break the too great a vertical blank, where such occur, were not main features, and though they conform to the law, they are not allowed to mark a new starting point for the calculation of the depth of the next higher cornice proper, which by such a procedure would possess no marked distinctive prominence, but be confounded with the less important bands of ornament, and deprive the elevation of *character*, reducing it to the insipidity of a blank wall with mere lines of ornament.

The law as disclosed in the cornices of the outer facade, (and by preference I have taken the west as being the one facing the main road, and therefore more important, and as the one which possesses, in the raised back wall, and in the higher Ladies' Chamber a greater number of bands and cornices in actual existence to enable the law to be deduced, as the one for examination) gives the results which will be seen in the "details of proportions of cornices and bands in Appendix IV. It is there seen that each band or cornice is in depth made equal to just a fourth of its

height from what I for convenience, call its zero of measurement; this zero being as before said, the next lower feature which for constructive reasons, it was an object with the arhitect to bring into prominence.

The law however does not hold in the interior facade nor in the interior cornices of domes, which appear to follow laws somewhat different, as however there are not enough of such various cornices to institute comparisons to deduce any law, and as the slope of the floor of the Masjid will vitiate any single calculation, it has been found impossible deduce definite laws for them.

Another law which governs the main cornices appears to be their division into 3 principal friezes. The minor bands have not these three friezes but less.

The friezes are proportioned as follows, of the total depth of cornice, the lowest frieze occupies $\frac{1}{3}$, the second frieze $\frac{1}{10}$, the third frieze $\frac{1}{7}$; topmost member above the friezes, consisting of mouldings is $\frac{1}{10}$, the principal ovolos are $\frac{1}{20}$.

I have not been able to think of and successfully investigate any other laws that may regulate other features not yet noticed, or other laws which may hold in the features already noticed.

A few words are necessary regarding the unit of measure employed by the architect in his design. It is scarcely necessary to go into an elaborate argument to maintain what will be admitted at once without any argument that the cubit, that universal Indian unit of linear measure must have been used; the only question is as to the length of the cubit used.

Prinsep gives a long list of the lengths of the cubit at various periods and in various places in India, I have tried all the likely measures, and find that the Bagdad cubit of $18\frac{3}{4}$ inches is the only one which gives results which agree fairly well with actual measurements, *and at the same time* gives the measures in such likely round figures as is given by no other measure. Nor is there any prima facie improbability in the use of the Bagdad cubit if it be remembered that shortly before the time the Masjid was started (A. D. 1360, it was finished in 1369) many learned men, architects among them no doubt, were driven out of Bagdad on the sack of Bagdad and the overthrow of the Khalifate in 1258 A.D. by Hulakû, and scattered into all surrounding Muhammadan Kingdoms, and that it is quite possible, indeed more than possible, probable, that the architect selected would be one, who, as having learned his art from Master from the seat of the Khalifate Bagdad, possessed the prestige which necessarily attached to this circumstance. It must not also be forgotten, that the throne of Bengal was itself filled for a time, at no distant period, by a dynasty whose founder came from Bagdad.

It is the double coincidence that gives me confidence to put forward the cubit of $18\frac{3}{4}$ inches as the measure most probably used. I am quite aware that when the unit of measure is but 18″ or 19″, the discrepancies between the actual and the calculated dimensions *cannot* exceed 9 or $9\frac{1}{2}$ inches, but it is a very different and a very much more difficult matter not only to get the variations more or less 6 inches, but *also to get with the measure such likely round figures as prima facie commend themselves to us as the ones which any architect with reasonable freedom would be likely to adopt:* take the main outer dimensions 516′ for length and 313 feet for breadth, $18\frac{3}{4}$″ gives the measure in cubits as 330 and 200 cubits respectively with a maximum difference between calculated and actual measures of only 6 inches, the differences of even $\frac{1}{8}$ inch in the unit would throw the round numbers hopelessly out; take again another principal feature, the clear span of the great nave inside, as well as its total breadth across including its wall, and we get 21 and 30 cubits respectively, with a discrepancy of $1\frac{1}{4}$ and 3″ respectively, take another great feature the great block rising sheer up with the main great arch in it, the breadth across is 33 cubits and the height 44 cubits with an error of 7″ and nil respectively; even in the basis of composition of the Masjid (see infra) the basis of the plan is the circle of $77\frac{1}{2}$ feet or 50 cubits while the larger central circle of $103\frac{1}{3}$ feet corresponds to 66 cubits and the smaller for the minor cloisters to 33 cubits. In the elevation the basis of the composition the circle of $32\frac{1}{4}$ feet in diameter corresponds to 21 cubits. For a detail of many of the principal dimensions, with their equivalents in cubits see appendix.

At the present stage of research into the laws that governed Muhammadan architecture, it appears to me desirable to notice and record all obvious proportions between the various parts of the building whether in details or in the basis of composition; not that I consider that every such proportion must turn out to be a law, but that in my opinion, (and I believe it is the opinion of all who enter into the professional study of a new science, with the wholesome diffidence of earnest inquirers), the science of architecture as practised by the great Mahammadan architects in India is not in such a state of advancement as to enable earnest students to pronounce ex-cathedra what may and what may not be laws, and the record now made may be of use in future. The proportions of various details will be found elsewhere in the body of the report and in the appendices; here I propose to record only the remarkable proportions which seem to hold in the composition of the design.

A plain oblong rectangular building, with a plain oblong rectangular open court within it, and with plain straight lined facades, is necessarily very simple in the composition and arrange-

ment of its main dimensions and outlines. It will be seen (pl. 88) that the plan is based on a series of 4 circles (or squares), 77½ feet in diameter each, ranged, two on each side of a central circle of one and one-third their size, for the Masjid proper; of a series of 10 circles 51½ feet in diameter for the East series of cloisters and half that number on each side, for the North and South wings. In elevation it will be seen also that the elevation of the East facade remembering that the corner towers are not towers that project beyond the face of the building, is filled in by a series of 16 circles 32¼ feet in diameter, and those of the North and South faces by 10 each (not shewn in the plate) while the West facade, which is lower, is filled in by a series of 8 circles or squares of a somewhat smaller size, 28⅔ feet, on each side of a central circle (or square) of twice their diameter. The facade on the inner or courtyard face of the West range, is equally simple, being (leaving out the North and South wings), simply a series of 5 circles or squares of the same size as in the other elevation that is 32¼ feet in diameter on each side of a circle of 2⅔ their diameter.

The largest circle which enters into the composition of the building, is the one which embraces the great central nave, this it will be seen is 103⅓ feet in diameter, that is 1⅓ times the diameter of the side circles (which are 77½ feet across) and as nearly as practically possible, twice the diameter of the smallest circles 51½ feet, which enter into the composition of the plan of the subordinate cloisters, while the circles 77½ feet in diameter which compose the Masjid proper are just 1½ times the size of those that make up the cloisters.

In elevation the great circle composing the central block of the nave is 2⅔ times (that is twice the 1⅓ times of the plan), the diameter of the circles that compose the wings, and just three times the size of the smallest circles which enter into the composition of the elevation.

Naturally with such a simple, and it may be said hopelessly tame composition, the beauty which comes of bold reliefs, and variety in outline, is out of the question; and although the architect has done his very utmost, to partially relieve this, by elaborately ornamented cornices, and panelled niches; these, at the distance, at which alone the whole facade of the building can be taken in by the eye at once, sink into insignificance: the long lines of battlements and the series of domes, of which the pinnacles would be visible, relieving the skyline; and the long series of lattices in the North, South and East facades, and of the arches in the inner facades, alone saving the building, from the oppressive monotony, of looking like a jail inclosure.

The West face does not however enjoy the whole of even these slight advantages, and although the bold projection and

variety, introduced by the Ladies projecting chamber, and its attached open vertibule, materially improves the appearance of the North half of the facade, the South half must always look drearily flat and monotonous. Notwithstanding that this is the back facade of the Masjid proper, and therefore more important than the facade of the East face and as such built of stone instead of brick and more profusely adorned than the East face.

On the whole, although the architect has done his very best to produce a good effect, by the profuse use of ornament, his efforts have been all but futile; and it would be difficult to find a building, which, costing as much as this one must have done, produces less effect, at the distance, at which alone, the whole of its vast size can be taken in by the eye. A building, built on the same lines and principles, but of one-fourth the size or less, would it appears to me, produce a greatly more pleasing effect; as the shorter distance, at which as a whole, it could be seen, would enable the details of ornament, in niches and cornices, to be visible, and to produce the effect, which their really beautiful forms and disposition are well calculated to do.

What that acute critical genius the late James Fergusson has somewhere said in regard to the Kutab Masjid may be applied to this, that it would be difficult to use such a profusion of ornament as is here used with so little effect.

But let not injustice be done to the architect. He had a hopeless task before him. A Masjid is but the expression in stone of the spirit of the religion which gave it birth: the severe monotheism of its worship, the uncompromising iconoclasm of its teaching and more than all, the universal political equality of its votaries, are only appropriately expressed in the straight lined square angled outlines of its temple, in the absence of symbolism in its composition, its forms and its sculpture, and in the universal dead level of monotony of its facade, while if the simile be extended somewhat, the overpowering and æsthetically intolerable prominence of its main central prayer vault, but typifies, remotely though it be, the obtrusively self assertive unapproachable elevation of the Muhammadan God and of his friend the Prophet. That to Muhammadan eyes, the buildings must have been beautiful, who can doubt who has read the enthusiastic descriptions of the Masjid of Alauddin in Delhi by the famous Amir Khousrou in his Tarikh Alai and of other writers? But tastes as well as faiths differ.

# ART.

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Art in the Adina Masjid is represented by sculpture and coloring. I say coloring because the colored borderings and friezes can scarcely be called painting in its higher sense. The sculpture may at the outset be divided into two broad divisions pre-Muhammadan, and post-Muhammadan: the former comprising certain sculptures represented in plates 26, 27, 35, 37, 38, 39, 49, 52, 53, 64, 75, 79; in the elaborately sculptured door frames (of which unfortunately there are no photographs or detailed plates); and in photographs plates 93, 95, besides occasional pieces in other plates: the latter in all the other plates, figures, and photographs representing the subject of sculpture except plate 108 which is a photograph of some sculpture in Buddha Gaya, introduced for purposes of comparison.

Of the Hindu sculpture, the most striking and superb is beyond question the trefoil arch and pillars of the main prayer niche; nothing can exceed the richness of the flowing curves of scroll work. Beginning with the pillars which stand on bases ornamented only by deep mouldings, the richness of the sculpture gradually increases till it culminates in the inimitable Lion's head at the apex of the great trefoil; yet how graduated the increase! The base proper is quite devoid of floral ornament, but the deeply sunk lines of rich mouldings have a beauty of their own and enhance by their simple lines, the richness of the floral work above; the lowest few inches of the shaft is quite plain, over it comes the attached Kumbha base; I call it an attached base, because it partakes of the characters both of shaft and of base: being never found separate, but always in one piece with the rest of the shaft, it can scarcely be called a base, and yet its character is sufficiently distinct to form a distinct subdivision of the shaft: this is a peculiarity of Indian pillars to which architects have not given the attention it merits, for herein if any where is to be found one main difference between eastern and western pillars; the base mouldings of Greek and Roman or even gothic pillars are poor and quite unsuitable representatives of the Kumbha base; to understand the Kumbha base and the moulded base proper of Indian pillars, we must go back not to imaginary Greek influences and ideas, but to Assyria and Persepolis.

Fergusson in his work on the palaces of Nineveh and Persepolis, has given two drawings of pillars of the Persepolitan style of architecture, and it is difficult from his drawings to educe the Indian Kumbha base. I began in my younger days

by looking on Dr. James Fergusson as a very high authority on architecture in general and the highest on Indian and Eastern architecture in particular; subsequent knowledge has I fear much modified my views. I still look on him as a genius in architectural *criticism*, for who but a man with inborn genius could, without regular professional training or a day's practice as a professional architect, (in the words of Mr. Growse one who has "never ventured to do anything" himself "as a practical architect, but" who has "wisely kept to the safer role of critic") have written the voluminous criticisms on architecture that he has? But I cannot avoid perceiving, and I do so with regret, for one is always sorry to demolish ones idols, that however great as a *critic*, as an *authority*, he should have little weight; and I fully endorse, (though the remark is made in the field of Assyrian architecture with which I am not familiar), Mr. Loftus' (Chaldea and Susiana) well deserved rebuke to him, for ignoring in the face of irrefutable evidence, facts which go counter to his theories. But I will not confine myself to one example; his books, whether the Palaces of Nineveh and Persepolis or the more pretentions "Tree and Serpent worship" or the "Indian and Eastern architecture" or any other that may be chosen; contain the startling assertion, that the evidence of publicly exhibited genuine inscriptions, (whose genuineness he himself never dares to question,) might be impugned whenever such inscriptions run counter to conclusions derived by him from that vague thing which he calls "style" of architecture, a thing which he never, in any single passage of all his voluminous writings, (and I think in my original admiration of him I have read them all) ventures to define!

It may be thought that in thus attacking Dr. Fergusson (who by the way; and I am really sorry for it; is now no longer alive) I am going out of my way *wantonly*; it is not so; I am contending for a *principle*; the principle that chronology and history, shall as far as may be, depend on the evidence of reliable records: such as the writings of contemporary historians, and more guardedly those of later ones; but above all on contemporary *public inscriptions which cannot lie* and in a minor degree on coins and copper plates, which do occasionally though very rarely mislead; and I am really attacking not him but the most prominent exponent of the vicious principle persistently and pertinaciously enunciated and maintained by Dr. Fergusson, that the *ipse dixit* of an *expert* based on a vague thing which as regards Indian architecture has never yet been defined, but which has been, loosely named "style" (to the mystification of would be earnest inquirers) is to override engraved lithic or other contemporary evidence. For 15 years more or less I have

floundered in this mystification introduced by him and others into Egyptian, Assyrian and Indian Chronology, in which but for the later volumes of Cunningham and my personal intercourse with him, I might have, as regards India, been floundering to my dying day. It is a duty I owe to the Government which pays me, and to the public, should these lines chance to be published, that my little effort should be freely given to break this Armida ring, which would constrain earnest inquirers (except those of the highest genius, and I am not one of them unfortunately) to accept the ipse dixit of these experts without verification; at the peril of being excluded from the charmed circle in case of dissent.

A comparison of the forms of arches, of the pillars, of the ornamentation, and of the forms of the curves of scroll work, in what I call the Hindu sculptures in the Adina Masjid with the forms and details of plate 108 (sculptures from the Temple at Buddha Gaya), will shew that they cannot belong to periods far distant; but Fergusson in the teeth of evidence from inscriptions and records has arrived at the conclusion that the details of ornamentation and various parts of the Temple date to the 14th century (Indian and Eastern architecture) from the evidence of the vague thing he calls style; in short he has practically carried out his maxim that the evidence of style should in his hands override every other evidence; I cannot possibly allow such a vicious theory to pass unchallenged here, as to do so, would be to bring down the date of the Adina sculptures to the 14th century or thereabouts, therefore post-Muhammadan. And before proceeding further, it was necessary for me to denounce, in a forcible and convincing way a theory which can lead to such a result.

But to revert; if instead of Fergusson's drawings, we consult the original authorities. Le Brun, Flandin, Loftus (and others to whom I have not had access) or that easily procurable, and very generally valuable work "Rawlinson's Monarchies," we shall find that besides the pillars whose bases splay out, there are others whose bases have a distinct, though very slight *contraction*, producing the form of a bell with a slightly constricted throat; and others still, with what is almost a flattened ball shape; these are the direct ancestors of their Indian prototypes the pillars with the pear or vase shaped bases (and capitals) to be seen in ancient Indian architecture; specimens of which may be seen in the little pillars separating the 3 beams of the "Toran" in Cunningham's Bharhut, and elsewhere; from these vase bases, and indeed from the constricted bells, the transition to the Kumbha bases is simple and natural as may be seen illustrated in the case of capitals in Cunningham's volumes.

Whoever studies plates 22, 27, 29, vol. X Cunningham's reports, cannot fail to see the gradual evolution, from the constricted bell capital, of the usual Indian Kumbha capital; I have mentioned only the plates in vol. X as giving the clue, but to follow every step of the change, many plates which it would be tedious to enumerate, in his 22 volumes must be consulted. The *idea* is not mine but Cunningham's, I only apply to pillar bases what he has so successfully applied to their capitals, and in so doing shewn me my way.

That the origin of these Indian Kumbha bases is to be found in the pillars with the rounded bases standing on two steps, is proved by the Bharhut and the Buddha Gaya sculptures where almost every pillar represented in sculpture is either baseless or has the flattened ball base with an *octagonal* shaft rising out of it. The rectangular steps on which the ball base rests in the more ancient sculpture have become improved into the ornate rectangular bases proper, divided into two members by a very deep moulding; while the ball bases have been improved into the Kumbha *attached bases* and profusely ornamented by what Cunningham calls "turn-overs" which about the 7th century took the shape of sprays of fanciful drooping leaves and flowers of a highly ornate type. As an additional ornamentation on these drooping leaves and bunches, the Hindu pillars at Adina shew upright triangular leaflets, corresponding to the triangular undeveloped embryo leaves which envelop such upright shooting stems as the aloe for instance, out of a cluster of which, themselves beautifully ornamented, rises the smooth octagonal plain shaft proper of the pillar, bound at about three-fourths of its height by an ornamental cincture in relief, from which hang rows of strings of pearls; (pearls are conventionally so represented in Indian sculpture, as may be ascertained by inquiry from any well informed native Indian Master mason) and surmounted first by the Kumbha capital and finally by the cruciform sur-capital, these last two being the Indian prototypes of the Persepolitan bell capital, and the double animal capital respectively.

Over this cruciform sur-capital comes the Magar, scarcely recognisable now; but compare it with the Magars in plate IX Bharhut Stupa, in which latter shorten the lower jaw and the tongue, and elongate the upper jaw and its turned up snout, twist the tail into the half trefoil shape, ornament each scale, and fill the eyes, the ears, and the great bulky projecting head with fanciful floral curves, exaggerating each of these features and making each wrinkle into a graceful scroll; and the exquisite scroll ornament surmounting the cruciform sur-capital is the result: Now finally lead the tails of the two Magars (which form the trefoil) into the mouth of a Lion, the Lion's

head being ornamented precisely as the Magars' heads have been, each wrinkle expanded into agraceful sunk curve, each hair into an exquisite relief scroll, the eyes, the nose, the ears, each undergoing the floral transformation, and we have as a final result the inimitable trefoil of the great prayer niche of the Adina Masjid with its exquisitety free flowing curves of scroll work.

I am writing with an enlarged photographic print (20 × 15) of the trefoil before me, but I have only one copy of this superb enlargement, executed in London from my photograph at my private cost. Plate 95, will with a good magnifier shew most of the details which I am writing about.

Should the Government however wish to have the enlarged copies of this truly superb work of art, I shall gladly authorise Mr. G. W. Austen, photographic artist, 69, Queen's Road, Finsbury Park, to let the Government have as many copies as necessary, on payment of his charges, the negative my property being still with him: A strict order of the Director-General debars me from paying more than Rupees 4 per negative and annas 4 (about threepence or rather less) per print of the size of 10 × 8; as my single print, alone, taken be it remembered from my own negative, has cost me a guinea in England, it is clear, I could not without disobedience of the distinct and re-iterated orders of the Director-General, procure for the Government copies of my photographs of this superb piece of sculpture, the finest certainly in Bengal.

If after having obeyed orders, I may be permitted to express my views. I would respectfully represent, that it does not appear to me, that the true interests either of art or of the Government (which is spending several thousand rupees annually for the adequate illustration and record of Indian Art as one of the objects of the archœological survey), is advanced by tying down an officer who can be trusted with the all but independent conduct of the survey of two Provinces, with such hard fast and narrow rules, as that which has prevented me from including a proper photograph of this superb work of art among the one hundred and eleven plates which illustrate this report.

Besides this piece of Hindu sculpture, the main prayer niche has other Hindu sculptures, notably the pilasters used as an architrave over the rectangular framing, within which the niche is cut, and just under the long inscription over the niche; there appear to have been used for the architrave three pilasters of rich workmanship with very distinct Kumbha bases and capitals. There are besides, some minor sculptures, shewn in plates 48 fig. 28, 52 fig. 18 pl. 53 figs. 9, pl. 23; (the figures shewing by a reference to index plate, 25 the positions of the sculptures on the prayer

niche; fig. 16 plate 49 may also be Hindu, though comparing it with fig 9 plate 53 the comparatively formal stiffness of the lines of the shoot within the niche, as well as the form of the niche (a cinquefoil one) leads me to doubt its having been originally Hindu and to regard it as a Muhammadan imitation of Hindu work.

The Hindu execution of fig. 9 is shewn not only by the freedom of the curves of the foliage and tendrils of the fanciful flower shoot within the garland, but conclusively beyond cavil, by the bells and half lotus-bosses from which the garlands and bells hang; the garland or festoon appears to me, if the instinct of intelligent native Hindu masons be not unworthy of consideration in their knowledge of the conventional modes of representing objects in Indian art, to consist of a string of pearls for the innermost garland, followed by a garland of the common Indian marigold petals (a flower universally used in offerings by Hindus), with an outermost garland of coral; the bell and the lotus speak for themselves. Fig. 23 plate 53 shews interlaced garlands of the lotus *stalk*, and coral, hung from the mouths of the grotesque conventional Indian Lion's head (only half the Lion's head is shewn in the plate) with an upper border of gold amulets precisely like those made and worn to this day by those who can afford such expensive jewellery: fig. 28 pl. 48 represents a jewel of gold set with precious stone, it is a jewel almost always seen on the chests of Jaina figures and in the head dresses of Hindu and Buddhist figures, and is even now used by rich Hindu females as an adornment for their hair at the forehead.

The row of flat plain battlements fig. 9 plate 53 is apparently Muhammadan, replacing probably a freize of human figures destroyed by the iconoclastic Muhammadans.

Compared with the freely flowing lines of these Hindu sculptures detailed above, the Muhammadan sculpture illustrated in plates 40 to 52 and in plate 54 which give the sculptures of the main prayer niche, though in themselves beautiful, and such as would command admiration any where else, are utterly dwarfed and overshadowed: their lines appear too formal, the curves stiff, their endless repitition monotonous, their execution shallow and their smoothness coarse, beside the deep cut lines, polished rounded surfaces, and flowing forms, of the earlier work; and yet not many Muhammadan sculptures are any where executed with such smoothness as these, in so hard a material as blue black basalt; and few will deny the chaste beauty of the diamond and circle bordering figure 2 plate 40, the beauty of the interlaced floral borderings of figure 5 plate 40, figure 3 plate 42, figures 13 and 14 plate 50 or the flowing grace of the scroll and flower borderings in figure 1 plate 41, figures 4 and 10 plate 43

or of the fringe, figure 16 plate 49; while for filling in of larger surfaces, the geometrical patterns, figure 12 plate 44 or the floral patterns figure 6 plate 45, figure 7 plate 48, are above the average even of good Muhammadan work. The lamps sculptured, represented in figures 8 and 11 plates 46 and 47 I considered censers till Mr. J. H. Wilson, late Superintending Engineer, Western Circle, drew my attention to the distinct lines of flame in the triangular jets over the middle of their upper edges and quoted the passage of the Quran which compares Allah to the bright flame of a lamp, set in a niche, (and these are sculptured within the octagon of the prayer niche hollow.) With their chains and pendents, the lamps are appropriate ornaments of the prayer niche, and are not without beauty, but I hardly think, judging from the rude remains of lamps of metal dug up in the ruins, that they represented the lamps actually used in the aisles of the Masjid, though the lamps used in the main nave, and possibly made of silver, may have resembled the sculptured ones.

Plate 54 is an impression, taken before its disappearance; of the gold stone set as stated in page 23 supra at F. (plates 12 and 94) over the main prayar niche; it is important, as it contains the fish emblem, and it is fortunate, that at the instance of Mr. J. H. Wilson, after erecting scaffolding te reach this stone, I felt and examined it closely, and am able to furnish a mechanical impression of it; the emblem in the centre of the niche was clearly a fish, the very scales, much worn (they have not come out consequently in the impression) were there, and both Mr. Wilson and I were perfectly satisfied that the sculpture was a fish.

In an earlier page, a conjecture was put forward that the architect of this Masjid a was scholar of a Bagdad master architect, and this piece of sculpture supports the conjecture. The fish was a well known and frequently used emblem in Chaldean Babylonian and Assyrian mythology, and even passed into the, cuneiform Heiroglyphic for fish as five of the arrow headed strokes ranged roughly into the outline of a fish. See Rawlinson, Duncker, Ragozin for various versions of the worship and symbolism of the Fish God, Oannes, Nin Ninip, &c. The persistence of myths is well known, but even more fully established is the greater persistency of symbols; and the fact of the fish being a well known symbol in old Babylonia would secure its continuance even under altered meanings in the same country though various changes of its religion down even to the Khalifate. Its occurrence in the Adina Masjid concurrently with the use of the Bagdad cubit is at least remarkable, and may well excuse, until evidence as strong is forthcoming to the contrary, the supposition, hazarded in page 61 supra, that a Bagdad architect or a pupil of a Bagdad architect was the designer of the Adina Maisjd.

The inscription round the border of the stone is given in Ravenshaw's Gaur with its translation, its position may be seen in plates 12 and 94 at F.

The full triangle and 2 half triangles over the centre and ends of the prayer niche are probably intended as a sort of finish to the niche panel, they are plain, quite unsuited to the profusion of ornamental work below, and appear to me wholly unmeaning. The triangle over the inscribed fish panel appears to me to be a monogram, though I cannot read it, see also plate 12.

Before passing from the central prayer niche and the sculptures in the central section of the back wall of the vault, it is necessary to note, that over the head of the Magar (plate 95) disguised as above stated by a profusion of fanciful floral scroll work, there is a plain flat object resembling an urn holding a three-lobed flower. This object is so utterly out of keeping with its environment, that it is easy to perceive, even if its form did not proclaim the fact, that it is the Muhammadan architect's alteration of some idolatrous image which his iconoclastic spirit could not tolerate; comparing plate 95 with plate 108, (Buddha Gaya sculpture,) it is seen at once that over the heads of the Magars must have stood sculptures of some living objects, (probably of Ganga, with a corresponding one of the Jamna on the other side of the niche) in the usual conventional human form; whether the figures were of Ganga and Jamna or of other divinities in human form, or one of the sacred animals, they would be equally intolerable to Muhammadans and were accordingly chiselled off and replaced by the existing wholly unmeaning vases. As the figures of the Magar and of the Lion's head, had they been recognised by the Muhammadans would have also been destroyed, I am inclined to think, bearing in mind their very effective floral disguise, that the architect failed to recognise them, and taking them to be mere ornamental scroll work permitted them to remain both in the trefoil and in the rows of garlands already noticed.

Next to the great prayer niche, the most important piece of Hindu sculpture, even more important than the existing sculptured Hindu doorways, is the sculpture inserted in the prayer niche Z. plate 24 and shewn in plate 93. That this was clearly Hindu is so obvious that discussion to establish its Hindu origin is superfluous; but it is not only a piece of original Hindu work, it appears to me to be a complete Hindu doorway or entrance, transferred from one of the subordinate temples which no doubt once clustered round the great main temple of Aditya Sena!

The two pillars which support the trefoil appear to me, comparing them with the corresponding pillars in the main prayer inche to have been either slightly shifted forwards and closer to

each other or to have belonged to some other place and to have been put in here by the Muhammadans, probably the former: but behind the pillars, and seen somewhat dimly in shadow in the gap between the pillars and the plain wall on their outer sides, are a number of sculptures which not only establish the fact of this having been an entrance doorway (from the figures of the Dwarapalas or perhaps of subordinate divinities placed in niches at the lower parts of the jambs,) but further assign an inferior limit to the age of the temple to which it belonged by the evidence of the figures projecting to the right and left respectively from the right and left sides of the right and left pillars near their capitals: no instance that I can now call to mind, occurs of this custom in buildings later than the 7th century: the figures are defaced and covered with mortar, which from the awkward position of the sculpture I could not clear away sufficiently to enable me to identify them; but probably, (as Cunningham in other examples pointed out for the first time,) they were figures of Ganges and Jamna, and conclusively fix the inferior limit to their age as the 7th ceutury A. D.

These figures the architect originally hid away by thin slabs of stone, one of which I found already fallen out, and the other being loose, I pulled it out to confirm the partial evidence of the other.

But over and above the inferior limit to the age furnished by this most important Hindu remnant, this doorway furnishes an outline of the sort of roof used at the time it was executed; and we see from this, that the tall towering Sikhara had not yet come into general use, at least not in Hindu temple-architecture in this part of India. We know from the evidence of the Buddha Gaya temple that it had been in use many years previously for Buddhist Temples, but I am not aware of any originally Hindu (not converted Buddhist) temple of this early age the 7th century, with a tall Sikhara roof; and the absence of the Amalaka ornament so frequent in ruins of Hindu temples is some confirmation of my inference.

It is possible that the great central temple had a Sikhara, and that this doorway belonging to only a subordinate temple, gives a representation of the mode of roofing such temples only. Further investigation elsewhere can alone settle this question: what this sculpture teaches is, that the smaller temples not only had their roofs in receding steps, (5 are seen here but there may have been other steps higher up destroyed by the Muhammadans) but also that the plan of the temples in external outline was a square of which each face presented a large central projecting facet, flanked on each side by 2 smaller successively receding facets, a form which continued common enough for many years subsequent to the 7th century A. D. The

beautiful temples in the salt range have already familiarised us with the frequent if not invariable use there of the trefoil in Hindu architecture, about this period; the sculptures in basalt of Purnna Varmma in Buddha Gaya prove its common use in the 7th century in Magadha, and now these trefoils prove that in Bengal also their use was neither unknown nor uncommon: in brief; that in Northern India, as late as the 6th or 7th centuries, the trefoil arch was used in temple architecture.

The lozenge and rosette ornament running along the innermost curve of the trefoil is a well known and common Hindu bordering; and represents if the traditions of modern Hindu masons be worth any thing, a border of gold brocade.

Confirmation of this is here furnished in the graceful fringe which hangs from the same bordering on the lines of receding stepped roof; they obviously represent the gold thread and silk twisted fringe which is frequently attached to brocade.

The central ornament of the pinnacle is the usual conventional lion peeping out of the conventional cave, while from his mouth hangs a panchlahri (five stringed garland) down to a second and larger Lion's head who peeps out from a second larger cave and from whose mouth flows forth the brocade bordering of the trefoil arch.

It is necessary I think to point out distinctly, for it has not before been done, that these two horse shoe shaped objects one over the other, whence project out the Lion's heads, are the conventional Hindu representations of rock cut caves: the ornament here represents a cave of two storeys; elsewhere may be seen caves of 3, 4, 5 or more tiers, while the earlier freizes. capitals and other plain borderings are invariably and frequently ornamented with representations of these caves. So many various names have been given to this object, and its origin and intention have been so often misrepresented, misconcieved, and even its form, through misconception of what it really represents, has been so often modified accordingly, that it is not superfluous to point out what it really is. One has only carefully to look at the great cave facades in Fergusson's folio works, in his and Burgess' cave temples of India, and elsewhere where Indian caves with the horse shoe roofs are represented, to need no further evidence, that this and no other is the object sought to be conventionally represented by all such horse shoe niches wherever occurring. Some identifications are so palpably obvious, that one has merely to point them out; they need no elaborate proof, to insure their immediate acceptance; and this is one of those.

Passing on now to the side prayer niche in the great vault, it is to be noted that the following appear Hindu. Plate 26 fig.

9 where the bell (seen only in halves at the 2 margins) conventionally and fancifully represented, stamps this running fringe of pearl garland and bells hung with coral chains, as Hindu; it is worthy of note that the flower and stalk represented within the garland has leaves and tendrils unsymmetrically arranged yet balancing each other in a way foreign to the regular symmetry of Muhammadan patterns.

(Plate 27) fig. 30 appears to me Hindu, and although the running horizontal border below, is undoubtedly Muhammadan the awkward curve joining the upper trefoil and volute to the border, leads me to suppose that originally, in the Hindu work, from the position it occupied (see plates 25 and 96) it must have formed the tail of the Magar whose turned up snout here faced the Hindu trefoil, and I consider that with their usual iconoclastic zeal the Muhammadans, recognising the animal, chiselled away its snout and body; and carved their own comparatively formal and certainly monotonous running border to replace it: the existence of the little tongue, just below the springing line of the Muhammadan cinquefoil arch confirms my supposition; of course as the corrollary to my supposition, the cinquefoil arch must be Muhammadan, which is almost certain judging from its bordering see fig. 31 plate 34.

I cannot with such abundanceof evidence before my eyes as is furnished by the plates of sculpture which accompany the report, and others which I have considered superfluous to submit (though the material is in my possession) admit the supposition that the beautiful scroll work exquisitely balanced on the whole, yet charmingly unsymmetrical in its details, can be the work of the sculptors who produced the totally different *class* of monotonously regular and painfully symmetrical sculptures which from their shallow depth of execution must be stamped even by unæsthetic and untrained eyes, as the work of sculptors of a wholly different school; even where they have tried to imitate the work of the other school as in the running border fig. 20 plate 29 for an example or fig. 11 plate 35, the result is a signal failure, the curves being too formal; (plate 35) fig. 10 is also Hindu as is proved by the yak Chaunris (fly flappers) and bell hung from the bordering of the garland of pearls by strings of coral; the two pods with their seeds shewing through, might help to fix the plant intended to be represented) it assuredly is not the poppy, but what it is I am unable to conjecture.

(Plate 37) fig. 26, and (plate 38) fig. 33 are so palpably stamped Hindu by the yak tail Chaunries and bells, that were other more prominent examples wanting, the charming want of geometric symmetry in the filling of their garlands might alone serve as a criterion to distinguish Hindu from Muhammadan work.

Of the rest of the plates which illustrate the sculpture, almost all are clearly Muhammadan work; I do not for a moment mean to assert that they are not beautiful specimens of ara besque ornament, all I mean to assert, and which I have said enough now to clearly point out, not to artists or experts, but to others (for I have a hope that the report will some day come to be published) is, that there is an *essential* difference in the *spirit* of the two sculptures Hindu and Muhammadan; the one wholly irregular in detail yet as a whole well balanced, permitting a freedom of fancy and a flow of curve, which it was simply hopeless to attain with the symmetrical and therefore necessarily more formal lines of the other; charming from its very wantonness, yet unsurpassed *as a whole* in balance, by the most rigid of the geometrically correct lines of the other. The one an expression of free *genuis*, the other an outcome of a shackled *industry*.

Little further needs to be added, plates 56 to 64 represent the sculptures or more properly arabesques from the so called pulpit, among which only figs. 6, 7, plate 64 appear to be Hindu. For some Hindu sculpture concealed by the architect turning the sculptured face of the stone inwards, and now exposed see Ravenshaw plates 40, 41; plate 64 of the illustrations accompanying this report; and Cunningham vol. XV.

Plates 66 to 87 represent sculptures from the Ladies' platform or gallery. Among these, fig. plate 79 is a modified Hindu sculpture, representing the roof of a temple in 5 receding steps, as in plate 93, with turned up corners and crowned by an Amalaka; the trefoil is a Hindu trefoil from its proportions, but in place of the figure of the god or goddess which it once inshrined, is now carved a lamp or censer.

Fig. G plate 75 a running border of diamonds and lotuses, appears Hindu; the panel inside, which once probably inshrined a Hindu figure is now cut into a cinquefoil cusped arch, with a censer or lamp inside.

In conclusion I may add that the lettering or numbering of the figures in these plates is meant to indicate the positions the figures occupy in the various niches: plate 25 is the index for plates 26 to 53; the position of plate 54 has been indicated before; plate 55 is the index for plates 56 to 64; plate 65 is the index for plates 66 to 87.

By a reference to the indices the positions of the various sculptures will be seen, the index plates being lettered and numbered to correspond to the lettering and numbering of the figures in the plates.

Jos. D. MELIK BEGLAR.

## APPENDIX I.

**Detail of method of setting the ornamental bricks in the Adina Masjid.**

The domes spring from rows of ornamental bricks set flat with their ends exposed, resting on a freize of bricks set as detailed below for the particular patterns which occur in any particular dome.

Plate I. The mouldings and ornamental parts wherever occuring similar to *a b′ b″ c d d′ f f′ h j m n o* have the bricks set with their beds horizontal, but in the freizes *b b′ b″* the bricks though set horizontally, present their narrow ends to view, while the others present the longer sides of the bricks to view.

The ornamental chains in the niches are in all cases made of bricks set vertically with their narrow ends exposed to view.

The bosses or censers of various patterns hanging from the chains. The bosses in the spandrils, as well as the ornamental battlements, over the niches and their vertical divisions, whether plain or ornamental, separating the battlements, (and to be seen in plate VIII) though of varying shapes; as also the central ornament of this line of battlements wherever occurring, are in all instances made of bricks specially moulded for their places and placed vertically.

The broad freize of ornamental festoons or scroll work under the niches wherever occurring, and under the empty pedestals on the West facade, as well as the bordering round the niches, both square and curved portions, are in all cases of bricks set vertically, flat against the wall.

In the freize *i* in all cases the bricks are placed vertical, but whereas the pillars separating the miniature arches, are of bricks presenting their ends to view, the arched panellings are of bricks set flat up against the wall.

The lattices are, in all cases, made of bricks specially moulded, and set horizontal, with their ends exposed to view.

The little foot pieces at the feet of the various lattices wherever of brick, are of specially moulded large bricks.

In the freize *k* in all cases the bricks forming the divisions between the panelling are set vertical with their ends exposed to view but the bricks forming the panels are differently set.

The finials *g* over the niches, though of various shapes are in all cases made of specially moulded brick set with the vertical moulded end in view.

In plate II the mouldings *r s* and similar mouldings wherever occurring, are of brick set horizontally, with their sides exposed to view, as are also all the mouldings, *l*. dividing the rows of lattice-openings in the latticed windows, though their forms vary in the various lattices, as well as all the lines of moulding at *p*.

The boss *q* is specially moulded and set vertical against the wall.

In plate V, the lines *t n v w* and similar work wherever occurring are of bricks set horizontally; *t* and *w* so far as can be judged, with their ends exposed to view, the other two with the ornament on their exposed sides.

In plates VIII and XXI, lines *x x′ y z* and similar lines wherever occurring are of bricks set horizontally.

In the central niche (only half is shewn in the drawing) between the 1st and 2nd lines of cornices, the pillars are built of bricks both vertically and horizontally set, the narrow moulding and the moulding separating the two panels into which the shaft is divided being horizontal, while the panels themselves forming the shaft of the pillar are set vertically. The ornamental line E. under the central niche, as well as E.′ in the pedestals (without niches) between the 2nd and 3rd cornices, and E.″ over some of the niches, and similar work wherever occurring, is of brick set horizontally, with their sides exposed to view, while *r r′* set also horizontally expose their ends to view.

The lines *A B D G H J K L M X Y Z* are all laid horizontally, while *F* and *I I′ I I″* and *W* are set flat vertically against the wall, and the corbels *C* as well as the pieces *C′ C″* are specially moulded bricks presenting their moulded ends to view.

The turned up ends N. of the cornices in both plates are of specially moulded large brick bedded horizontally.

The lines *O P Q S T* in the lowest or 1st cornice are all of bricks bedded horizontally and presenting their ornamented sides to view, the forms of ornament in each line is not the same throughout its entire vast length along the facades, but though the forms of ornament cut on the bricks vary, the mode of setting is the same.

The bricks for the freize V. however, varying also in form of ornamentation in different parts of its length, appear to have been moulded and set flat vertically against the wall.

The bases of the pillars and of the vertical bordering of the niches on the external facades wherever any exist, are of bricks specially moulded of a large size and set horizontally.

The freize *U* in plate XXI. consists of vertical pillars of specially moulded and ornamental bricks set with their ends vertical, separating ornamental panels of brick set flat vertically against the wall. The freize surmounting this is simply a modified form of freize *i* of plate I and other plates already above noticed.

In plate XXII. There are no new mouldings, which or rather mouldings corresponding to which in other plates have not already been noticed, except some lines of ornaments at the tops of the latticed niches. These are of bricks set horizontally.

## APPENDIX II.

It will be seen that the surface of the floor of the Ladies' platform is divided off into squares by the pillars and beams resting on them; omitting for the purposes of this theoretical calculation for the strength of the supporting beams, the thickness of the pillars on the one hand, diminishing the actual load on the beams, and on the other, the weight of the beam itself, the squares are linear squares touching each other, of 12 feet side; 4 squares meeting each other at their corners over each pillar.

But as the beams extend in pairs from pillar to pillar, it will be seen that by distributing the surface into squares by drawing lines diagonally from pillar to pillar, the surface is divided into squares of exactly half the area of the original squares, 4 squares meeting each other at their corners, not on the centre of each pillar, but at the centre of each of the previous squares, and that each pair of beams running squarely from pillar to pillar supports one of these squares, of which it forms a diagonal; as the former squares have an area of 144 square feet these which are exactly half the size have an area of 72 square feet, or with 5″ flooring slabs, of 30 cubic feet.

The 2 minor beams which rest on the centres of each principal beam in all squares covered by the method of "intersecting squares," have a volume of 4 c. f. each, $\frac{1}{2}$ of which is borne by each beam.

The total volume therefore supported amounts to 34 c. f. or 58 cwt. nearly @ 187 lbs. to the c. f. (see Rankine).

On such a square the live load would probably not exceed 8 women, or say 4 women over each beam, taking each @ $\frac{3}{4}$ cwt. including children, there would have to be added 3 cwt. of live load, equivalent to 6 cwt. of dead load to the previously found 58 cwt. of dead load; a total of 64 cwt. of load, on each beam.

As Engineers allow 8 for a factor of safety for stone, and from the circumstance that these beams have stood out the assults of time, accident, and violence, there is every reason to regard them as really being 8 times stronger than the calculated strength by breaking load would give, the equation stands thus.

$8 \times 64 = 2\ C\ \frac{bd^2}{L}$ where as in the text $b$ is 10″ $d$ 11″ and $L$ is $6\frac{1}{3}'$ which gives the value of $C$, as 1·3 cwt. for the particular kind of granite used; and as said before, considering that there is justification for regarding 8 as the factor of safety allowed: a value on the face of it probable, and sufficiently reasonable to justify acceptance.

The beam it will be seen has been assumed to be loose at the end, for as the beams rest on the corbels which jut out, not from the centre, but from the edges of the abacus, their mitred ends can scarcely if at all be pinned down by the upper monolithic fluted columns, while obviously the clear span which ought to be assumed, is the clear space not between the capitals of the pillars, but between the ends of the opposing corbelled supports.

## APPENDIX III.

**Details of Forces—**

| | | | |
|---|---|---|---|
| Direct crushing force on walls at plinth average ... | ... | 3· 8 | tons per. sq. ft. |
| Direct at foundations | ... | 3·45 | „ „ |
| On square bases of pillars ordinary | | 1·65 | „ „ |
| „ „ tall ones | ... | 1· 7 | „ „ |
| „ base of round shaft | ... | 3· 6 | „ „ |
| „ necks of columns | ... | 4· 6 | „ „ |
| „ on ordinary west wall at plinth ... | ... | 1· 5 | „ „ |
| „ at foundations | ... | 1· 5 | nearly „ |
| „ back wall of nave at plinth | | 6· 2 | „ „ |
| „ „ at foundations | ... | 5· 7 | „ „ |
| „ abutments at floor | ... | 4· 9 | „ „ |
| „ east wall at plinth | ... | 2· 1 | „ „ |
| „ piers of nave at floor | ... | 12· 5 | „ „ |
| „ piers facing court average at floor west | ... | 2·25 | „ „ |
| „ east | ... | 4· 0 | „ „ |

*Thrust of Vault.*

Let the full lines in fig 6 plate 88 represent a Section of the vault (it is accurrate, and correctly drawn except the lines $H\,C\,H'\,C$ which are conjectural), it is obvious from this Section and from the form and amplitude of the arch and its backing between the points $C'$ (the crown) and $T$ that there is no point of rupture between $T$ and $C'$, and it is not necessary to go into further complicated details regarding the stability of this part taken in itself, so that for the subsequent calculations, to simplify what is notoriously one of the most laboriously intricate calculations, this portion may be assumed as in itself a stable solid piece.

The weak point of the arch is at once seen to be $T\,Q$ and to insure stability, the forces should be so balanced that the piece $T\,Q\,H\,C\,C'$ should have no tendency to rotate round the points $T$ or $Q$.

Assuming that the thrust at the crown normal to the radial joint $C' R$ acts through the middle third of the voissoir, as it ought to in all well built arches, and for simplicity that it may be supposed to act through $P$ the middle of $C' R$ (any moderate variation in the actual position of the point $P$ will it will be seen not have any great effect on the result, and the alteration of values can be easily made in the equations if desired).

We have for the limiting values of the thrust at $P$ the equations.

$$p.' \times T S = w \times T D \text{ or } p.' = \frac{w\ T\ D}{T\ S}$$

$$p.' \times Q S' = w \times q\ d' \text{ or } p.' = \frac{w\ Q\ D'}{Q\ S'}$$

where $T S$, $Q S'$ are the perpendiculars on the line of thrust at crown from $T$ and $Q$ respectively and $T D$ $Q D'$ the perpendiculars on the line of action of the weight $w$ of the piece $Q T C' C H$, (which amounts to 6,820 lbs.) acting through its centre of gravity $G$, and $p.$ and $p.'$ the maximum and minimum values respectively of the normal thrust at the radial joint at the crown; giving the numerical values of the symbols it is found that $p.=$ 5,541 lbs. and $p.' = 1{,}577$ lbs.

The weight which acting on the wedge shaped keystone $R C' R'$ would produce the pressures $p.$ $p.'$ would be $2p.$ Cos. 75 and $2p.'$ Cos. 75 respectively very nearly (75 degrees being the angle very nearly which the direction of the line $P S$ makes with the vertical) or giving their numerical values, the limiting maximum and minimum weights on the crown compatible with theoretical stability would be 2,868 lbs. and 816 lbs. representing respectively 24 and 7 cubic feet of masonry, neither of which are intrinsically of such magnitude that we can on the score of improbability alone reject either, but must consider it as quite within the limits of possibility that the load *may* have amounted to somewhere approaching the maximum limit of 24 cubic feet, while it could not be less than 7 cubic feet. It is needful to remember that the wedge $R C' R'$ is itself alone more than 3 cubic feet, and that it is not without its corresponding weight.

Prolonging the vertical representing the line of action of the weight of the semi arch and its backing to meet the line of thrust at $B$, it will be seen, that the resultants $t$ $t'$ of the pressures $p.$ $p.'$ and weight $w$ will be given by the equations.

$$t^2 = p^2 + w^2 + 2\ p\ w \text{ Cos. } 75$$

$$\text{and } t'^2 = p'^2 + w^2 + 2 p' w \text{ Cos. } 75$$

whence giving the numerical values, $t$ and $t'$ the maximum and minimum final thrusts compatible with the stability of the arch

$T\ C'$ are found to be $t$=9,837 lbs. $t'$=7,387 lbs. and the angles with they make with the vertical are 33 degrees and 12 degrees respectively. As may have been inferred without calculation, the directions so found pass through the points $T$ and $Q$.

The force which tends to overturn the piers is found in the two limiting cases from the equations.

$$f = \frac{450\ t\ \text{Sin. } 33^\circ}{12 \times 2240} \qquad f' = \frac{430\ t'\ \text{Sin. } 12^\circ}{12 \times 2240}$$

where $f$ and $f'$ are the maxima and minima moments in foot-tons tending to overturn the piers, and 450 and 430 the leverage (in inches) at which the respective forces act, or the vertical distances of $Q$ and $T$ from the floor of the nave, and 12 and 2240 the divisors needful to convert the inches and lbs into feet and tons.

Substituting the values of $t$ and $t'$ found above, $f$ and $f'$ are found to be 90 and 24½ foot-tons respectively nearly, which is the force tending to over turn the piers per *foot length* of the vault. The moment of stability of the piers after making the necessary deductions for the open archways, amounts on the average per foot length to 34·5 foot tons.

It is necessary to note that in the above calculations fractions of inches and degrees have been omitted for simplicity, and that the final results are consequently not mathematically accurate, but the accuracy is such as is quite sufficient for the purpose of this investigation and for all practical purposes.

Friction too has been left out of account as well as the tenacity or cohesion of the mortar, as also its compressibility, these working respectively for and against stability, are usually left out in such calculations and help to some extent to neutralise the effects of each other.

The calculations lastly are as is evident, for statical forces, the moments are all statical moments. No dynamical elements have been considered, for the sufficient reason that the instant actual dynamic motion takes place, and dynamic forces claim to enter the calculations the structure as a *stable structure* has ceased to exist.

## APPENDIX IV.

### Details of proportions of various features of the Adina Masjid.

*Detail of proportions of pillars.*

Lower pillars of Ladies' platform, probably Muhammadan—,

| | | | |
|---|---|---|---|
| Height of shaft | ... | 3 | Semidiameters. |
| Height of capital | ... | $\frac{2}{5}$ | „ |
| „ „ corbel | ... | $\frac{2}{5}$ | „ nearly. |
| „ „ base | ... | $\frac{1}{3}$ | |
| Projection of corbel | ... | $\frac{2}{5}$ | „ „ |

And in the upper fluted pillars of the Ladies' platform which are probably Muhammadan—

| | | | |
|---|---|---|---|
| Height of fluted shaft | ... | 4 | Semidiameters. |
| „ „ base | ... | $\frac{3}{4}$ | „ |
| „ „ neck of capital | ... | $\frac{3}{4}$ | „ |
| „ „ capital | ... | $1\frac{1}{4}$ | „ |
| Diminution of shaft | ... | $\frac{1}{9}$ | „ |
| Breadth of base | ... | $2\frac{2}{3}$ | „ |
| „ „ capital | ... | 3 | „ |

In the pillars on the sides of the minor prayer niches as well as those of the Ladies' platform which appear to be all Hindu, the proportions are (the pillars are indented rectangular, the Semidiameter here means the breadth including the projections in the centres of the faces.)

| | | | |
|---|---|---|---|
| Height of shaft | ... | 11 | Semidiameters. |
| „ „ base | ... | 2 | „ |
| „ „ capital | ... | 1 | „ |
| „ „ corbelled sur capital | | 1 | „ |
| Breadth of base | ... | 3 | „ |
| „ „ capital | ... | $2\frac{1}{2}$ | „ |
| „ „ corbel | ... | 3 | „ |

In the pillars of the prayer niche N. (see index plate and plate 23) which is certainly Hindu, the proportions are :—

| | | | |
|---|---|---|---|
| Height of shaft | ... | $12\frac{1}{4}$ | Semidiameters. |
| „ „ base | ... | 2 | „ |
| „ „ Kumbha base or attached base | ... | 1 | „ |

APPENDIX VI.—(*Continued.*)

| | | |
|---|---|---|
| Height of capital with neck... | 1 | Semidiameters. |
| Corbelled sur-capital ... | 1 | „ |
| „ abacus ... | 1 | „ |
| Breadth of base ... | 3 | „ |
| „ „ corbelled capital ... | $2\frac{2}{3}$ | „ |
| Diminution of shaft ... | $\frac{1}{2}$ | „ |

In the pillars of the main prayer niche the proportions are:—

| | | |
|---|---|---|
| Base ... ... | $1\frac{3}{4}$ | Semidiameters. |
| Sur-base plain part ... | $\frac{3}{4}$ | „ |
| Kumbha base ... ... | 2 | „ |
| Neck ... ... | $1\frac{1}{4}$ | „ |
| Total of shaft including neck and sur-bases ... ... | $11\frac{3}{4}$ | „ |
| Capital ... ... | $\frac{1}{2}$ | „ |
| Sur-capital or corbel and abacus | $\frac{3}{4}$ | „ |
| Breadth of base ... ... | 3 | „ |
| Diminution of shaft ... | $\frac{1}{2}$ | „ |

In the pillars of the side prayer niches of vault, the proportions are:—

| | | |
|---|---|---|
| Base ... ... | 2 | Semidiameters. |
| Shaft ... ... | $11\frac{1}{2}$ | „ |
| Capital ... ... | 1 | „ |
| Sur-capital ... ... | 1 | „ |
| Breadth of base ... ... | 3 | „ |
| Diminution of shaft ... ... | Nil. | |

In the upper pillars of the pulpit the proportions are:—

| | | |
|---|---|---|
| Base ... ... | $1\frac{1}{2}$ | Semidiameters. |
| Shaft ... ... | 10 | „ |
| Capital ... ... | $1\frac{1}{2}$ | „ |
| Breadth of base ... ... | $1\frac{1}{2}$ | „ |
| Diminution of shaft ... | $\frac{1}{3}$ | „ |

## DETAILS OF PROPORTIONS OF BOSSES.

*Distance between Centres.*

| Breadth of rectangular panel inclosing arch or opening. | Distance between centres of bosses. | Proportion. | Breadth of rectangular panel inclosing arch or opening. | Distance between centre of Bosses. | Proportion. |
|---|---|---|---|---|---|
| 49 | 39 | ·78 | 43 | 35 | ·82 |
| 49 | 40 | ·78 | 36 | 27 | ·75 |
| 18 | 13 | ·76 | 61 | 50 | ·82 |
| 61 | 49 | ·80 | 39 | 32 | ·88 |
| 41 | 32 | ·78 | 49 | 36 | ·73 |
| 34 | 29 | ·85 | 49 | 37 | ·75 |
| 50 | 38 | ·75 | 43 | 33 | ·77 |
| 40 | 30 | ·75 | 50 | 41 | ·82 |
| 46 | 36 | ·78 | 19 | 13 | ·68 |
| 83 | 64 | ·77 | | | |

## DETAILS OF PROPORTIONS OF BOSSES.

*Distance below upper Line.*

| Height from spring to top of panel. | Height from centre of boss to top of panel. | Proportion. |
|---|---|---|
| 16 | 5 | ·31 |
| 15 | 4½ | ·30 |
| 60 | 20 | ·33 |
| 31 | 12 | ·37 |
| 25 | 5 | ·20 |
| 26 | 9 | ·35 |
| 17 | 5½ | ·32 |
| 27 | 9 | ·33 |
| 16 | 5 | ·31 |
| 47 | 21 | ·45 |
| 14 | 3 | ·21 |
| 53 | 13 | ·25 |

# DETAILS OF PROPORTIONS OF CORNICES & BANDS

| Position and Particulars of Cornice or Band. | Height of its lowest member above base mouldings or above the next lower *cornice.* | Thickness or depth of cornice or band. | Proportion of depth of cornice or band to height at which it is placed. |
|---|---|---|---|
| Lowest Band West wall on outside | 97″ | 26″ | ¼ nearly |
| Main cornice West wall (goes round building) outside ... | 198″ | 50 | ¼ „ |
| Cornice above main cornice in the raised central portion of back of vault ... ... ... | 112″ | 26 | ¼ „ |
| Ladies' Chamber band of floor plinth of chamber above base mouldings ... ... | 83″ | 22″ | ¼ „ |
| Main cornice above plinth of chamber ... ... | 222″ | 52 | ¼ „ |
| Inner facade ... ... | 243″ | 55 | ¼ „ |
| Interior cornice below domes ... | 240 | 24 | $\frac{1}{10}$ „ |

## APPENDIX V.

Some of the dimensions of the main features of the Adina Masjid with their equivalents in cubits of $18\frac{3}{4}$ inches.

| Detail of feature. | Cubits of $18\frac{3}{4}$ inches. | Equivalent in feet or in | Actual dimension. |
|---|---|---|---|
| Total length ... ... ... | 330 | 515ft. $6\frac{1}{2}$" | 516 ft. |
| „ breadth ... ... ... | 200 | 312ft.6in | 313 „ |
| „ Interior Court length ... ... | 268 | 418ft 9in | 419 „ |
| „ „ „ breadth ... ... | 119 | 186ft. | 186 „ |
| Breath of Masjid proper ... ... | 48 | 905 in. | 900 „ |
| Clear span across of nave ... ... | 21 | 394 „ | 393 „ |
| Breadth of nave with its walls ... ... | 30 | 563 „ | 566 „ |
| Span of central great arch ... ... | 26 | 487 „ | 480 „ |
| Breadth of central block including the great arch and its abutments ... ... | 33 | 619 „ | 626 „ |
| Do. do. including the wings ... ... | 50 | 937 „ | 926 „ |
| Height of top of battlements of Masjid proper above plinth at back ... ... | 18 | $337\frac{1}{2}$„ | 333 „ |
| Height of top of first row of battlements of central block above plinth at back ... | 27 | 506 „ | 500 „ |
| Height of battlements of Masjid proper inner or East face above floor ... ... | 18 | $337\frac{1}{2}$„ | 340 „ |
| Height of topmost battlements of great central nave, front or East face above floor ... | *44 | 825 „ | 825 „ |
| Total length including walls Ladies' Chamber... | 35 | 656 „ | 650 „ |
| Total length Ladies' vestibule ... ... | 26 | 489 „ | 490 „ |
| Height of floor Ladies' Chamber above plinth ... | 5 | 94 „ | 95 „ |
| Height of floor Ladies' platform above Masjid floor ... ... ... ... | 6 | 110 „ | 112 „ |
| Total height of battlements of Ladies' Chamber above *its* floor ... ... ... | 18 | 337 „ | 333 „ |
| Height of main cornice Masjid proper back, above plinth ... ... ... | 16 | 300 „ | 298 „ |
| Depth of cornice, total including footing of battlements ... ... ... | 3 | 56 „ | 60 „ |
| Depth of first ornamental band, exclusive of footing ... ... ... | 1 | $18\frac{3}{4}$„ | 19 „ |
| Span of arches in East facade Masjid proper ... | 5 | 94 „ | 97 „ |
| Span of side arches of great nave ... | 6 | $112\frac{1}{2}$„ | 113 „ |
| Back wall of nave thickness ... ... | 7 | 131 „ | 123 „ |
| Pulpit total height above floor ... ... | 11 | 206 „ | 209 „ |
| Breadth of pulpit across ... ... | 4 | 75 „ | 72 „ |
| Thickness of wall at back Masjid proper ... | 4 | 75 „ | 76 „ |
| Diameter of domes in Ladies' platform ... | 7 | 131 „ | 127 „ |
| „ „ Masjid proper public aisles | 7 | 131 „ | 128 „ |
| Clear span of arches Masjid proper ... | 7 | 131 „ | 126 „ |

* This is the traditional Bais Gaj.

## APPENDIX V—*(continued.)*

| Detail of feature. | Cubits of $18\frac{3}{4}$ inches. | Equivalent in feet or in. | Actual dimension. |
|---|---|---|---|
| Pillar to pillar Centres Masjid proper ... | 8 | 150 in. | 153 ft. |
| Ordinary prayer niches ... . | 3 | $56\frac{1}{2}$ „ | $56\frac{1}{2}$ „ |
| Diameter of Semicircle of ditto ... ... | 2 | $36\frac{1}{2}$ „ | $37\frac{1}{2}$ „ |
| Diameter of domes of cloisters ... ... | 6 | $112\frac{1}{2}$ „ | 117 „ |
| Span of arches cloisters ... ... | 6 | 113 „ | 117 „ |
| Pillar to pillar centres ... ... | 8 | 150 „ | 149 „ |
| Radius of arches, cloisters ... ... | 4 | 75 „ | 78 „ |
| Thickness of front wall East cloisters ... | 5 | 94 „ | 92 „ |
| „ inner wall cloisters ... | 5 | 94 „ | 87 „ |
| Total breadth of East cloisters ... | 27 | 506 „ | 511 „ |
| Great circle of composition of plan of Masjid ... | 66 | $1237\frac{1}{2}$ „ | 1236 „ |
| Main circle of Masjid wings ... | 50 | $937\frac{1}{2}$ „ | 930 „ |
| Small „ of Cloisters ... ... | 33 | 619 „ | 618 „ |
| Great circle of Elevation of Masjid proper back of vault .. ... | 36 | 675 „ | 680 „ |
| Small circle ditto ... ... | 18 | $337\frac{1}{2}$ „ | 340 „ |
| Masjid proper inner or main facade great circle | 55 | 1031 „ | 1032 „ |
| Main circle of Masjid proper wings ... | 21 | 394 „ | 387 „ |
| Small „ cloisters ... | 18 | $337\frac{1}{2}$ „ | 340 „ |